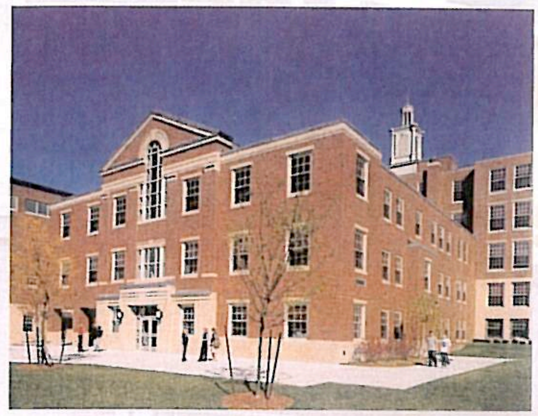
CEFPI
The School Building Association

A PRIMER FOR THE RENOVATION / REHABILITATION OF OLDER AND HISTORIC SCHOOLS



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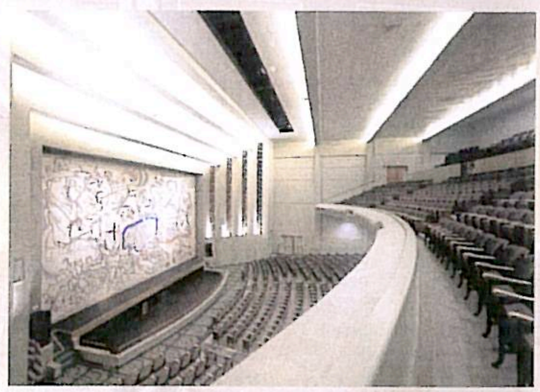

NCPTT
National Center for Preservation Technology and Training
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COVER IMAGES *(left to right)*

1 ~ Cool Springs Administrative Offices,
Rutherford County Schools, Forest City, NC
Boney Architects
(photo courtesy of Greg Loflin/The Loflin Group, Inc.)

Constructed in 1925, this building was originally a high school and middle school. In 1999, after having been abandoned for five years, it was converted into much needed office space for the Rutherford County School System including an on-site teacher training center, professional library and boardroom. Renovation of the school and the presence of school system staff have stimulated economic development in the downtown area and encouraged homeowners to improve adjacent properties.

2 ~ Elizabeth Traditional Elementary School,
Mecklenburg Schools, Charlotte, NC
Clark • Nexsen Architecture & Engineering
(photo courtesy of Clark • Nexsen Architecture & Engineering)

The renovation and expansion of Elizabeth Traditional Elementary School presented a number of design challenges given the tight, urban site. While the original 1925 neo-classical masonry structure was fully rehabilitated, later additions to the structure constructed in 1948 and 1972 were in poor condition and were replaced with a new addition without significantly increasing the building footprint. Another design challenge was the location of the school, which was adjacent to Independence Park, the oldest municipal park in Charlotte and a registered landmark. Joint development of the park property to permit student access during school hours allowed the school to fully utilize its 1.9 acre site.

3 ~ McCall Middle School, Winchester Public Schools,
Winchester, MA
HMFH Architects, Inc.
(photo courtesy of HMFH Architects and Anton Grassl Photography)

Originally designed as the town's high school in 1930, many spaces were inappropriate for a modern middle school program. In addition, the growing middle school population required additional space. Because of the building's historic importance to the town, the architect treated any change to the building with great sensitivity. Meticulous attention was paid to the addition's masonry and precast concrete detailing as well as its massing and scale to assure that it blend in with the neo-classical features of the original building. Similar attention was paid to the renovated interior which received new finishes that exemplify the historic colors and tile patterns of the preexisting building while providing the new program that the middle school required.

4 ~ Barnum Hall Theater
Santa Monica - Malibu Unified School District
WLC Architects
(photo courtesy of WLC Architects and Fred Daly Architectural Photography)

Built in 1938 in the classic Streamline Modern style by the Federal Works Project Administration, Barnum Hall served as Santa Monica High School's auditorium and the City of Santa Monica's Civic Auditorium. Closed in 1997 due to years of deferred maintenance, Barnum Hall was fully restored and reopened in 2004. Accessibility issues were an important consideration in renovating the theatre. In addition to restroom upgrades, ramps, elevators and wheelchair lifts were introduced to provide handicapped access to the main performance seating, the stage, the orchestra pit, dressing rooms and other building levels. These improvements were undertaken without negatively impacting historic building elements or the acoustics of the main performance area.

5 ~ Dunlap Elementary School, Seattle Public Schools,
Seattle, WA
DLR Group
(photo courtesy of Chris Roberts, DLR Group)

A historic landmark, Dunlap Elementary School has served as a focal point in the neighborhood for over 75 years. The design team was faced with the challenge of doubling the size of the school without compromising the historic nature of the facility. Space in the facility was reorganized to support the school's educational program. The existing lunch room was converted to a library while small classrooms were combined to accommodate kindergarten and special education programs. Building forms used to connect the historic school became conferencing centers, supporting team teaching and itinerant personnel.

FULL COVER IMAGE *(background)*

York High School, Elmhurst Community Unit School
District 205, Elmhurst, IL
Wight & Company
(photo courtesy of Wight & Company)

Prior to renovation in 2002, York High School consisted of a collage of numerous additions surrounding the original historical core dating to the 1920s. Years of patchwork modifications and shortsighted planning created a school that could not support modern educational delivery methods or technologies. Selective demolition of the obsolete additions, rehabilitation of the original buildings, and construction of a new academic wing linked to the existing campus restored both an organizational logic and architectural dignity to the school complex. The unique *Courtyard Commons* was designed to provide convenient access to services for students and visitors and incorporates the facades of the original 1926 *Tower Building* and 1929 *Baker Auditorium*.

The School Building Association

A Primer for the Renovation and Rehabilitation of Older and Historic Schools

Mark Gilberg, Ron Peters, and Janell Weihs

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Publisher's Remarks

We wish to introduce the authors who have contributed to *A Primer for the Renovation and Rehabilitation of Older and Historic Schools*. Many thanks to the following contributors for their commitment to historic preservation and for the time, expertise, and effort that have gone into the preparation of this volume:

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Why Renovate?

Older and historic schools represent an unrecognized asset for school districts. These schools were built during an era of high quality construction and significant community pride in education, and those that have survived to the present day are important community institutions that sustain the neighborhoods they serve. They provide cultural continuity, linking generations together through a common educational experience that pays benefits over time to the community and its school system. Many older schools, designed so that students could walk to school, provide small, personal educational settings—reflecting a style of education whose value has only recently been rediscovered by teachers, parents, and community leaders. To abandon or demolish such property without a thorough and creative look at their potential to continue to support twenty-first century educational programs is a waste of valuable community assets.

Yet, too often older school facilities are viewed as unredeemable liabilities, a sink with deferred maintenance waiting to be replaced at the first opportunity. As a consequence, our nation's older and historic schools are closing at an alarming rate (Beaumont and Pianca 2000; Lawrence et al 2002; Lawrence 2003a; and Rubman 2000). Various factors have caused these still-useful and often historic schools to fall victim to policies that promote the construction of new schools with little consideration of an alternative such as the comprehensive renovation of existing facilities. Among the several contributing factors to the wholesale destruction are acreage requirements, state funding biases, confusing or inflexible building codes, and antiquated and arbitrary formulas that compare the cost of renovations for older schools to the cost of construction for a new school.

When these buildings are abandoned, not just the school but also the entire neighborhood is put at risk. This is particularly true for neighborhoods where low and moderate-income families live and which commonly suffer from poor quality public services, declining property values, and other social ills that accompany decreased investment. Closing or replacing schools in rural towns or middle-income communities may change the quality of life for the neighborhood residents—for the worse. The closing of a neighborhood school is often a final blow to a community's chance for stability or revitalization. Even if the neighborhood is thriving, it may find its economic vitality crippled by

Exterior view of Fred Moore High School before renovation
(courtesy of VLK Architects)

Exterior view of Fred Moore High School after renovation
(courtesy of Craig Blackman, AIA)

Built in 1948, **Fred Moore High School** (originally known as Fred Douglas School) in Denton, Texas, was closed in 1968 following school integration. It was abandoned until 1994, when renovation began. Yet, the school still had strong ties to the community. Many families living in the surrounding neighborhood had attended the school as children. Even though the building's condition may have justified demolition, the local community wanted to renovate the facility for the district's alternative education program. The architectural design team worked closely with the school district and community to determine the best use for the facility. This collaboration resulted in a design solution that retained as much of the school's original character and architecture as was feasible, given the new educational program. The school now serves as an alternative-learning environment for academically challenged students. In addition to tutoring students in core curriculum subjects, the school offers alternative paths of development for students, such as career technology and job skills training. Though not listed on the National Register of Historic Places, the school is a local landmark and considered a key component in the revitalization of the surrounding African-American neighborhood, which uses the school for various after-hours functions. Project Architects: **VLK Architects, Inc.**

the loss of its school. Closing a neighborhood school in favor of a new school on the outskirts of town works a similar effect on local shops and businesses, as does the construction of "big box" stores or malls on the urban fringes.

Often older neighborhood schools are replaced by new construction on the urban fringe, accommodating larger campuses and ever-larger student populations. The construction of such schools tends to accelerate urban sprawl and increase public expenditures for infrastructure—including roads, buses, sidewalks, sewage, and water—while depleting farmland and open space and adding to congestion and pollution from motor vehicles. The costs associated with these effects, while hard to quantify, are nonetheless significant. The perceived savings associated with economies of scale drive the consolidation of smaller schools into larger campuses, yet the perception often proves false when indirect costs of sprawl and environmental degradation are calculated.

Recent studies have suggested smaller, community-based schools provide a better educational environment for students (Howley and Bickel 2002; Dolinsky and Frankl 1992; Lee and Smith 1997; Petkovich and Ching 1977; Nathan and Febey 2001; Sederberg 1987; Sell et al 1996; Stockard and Maynard 1992; Walsey 2000). Students benefit from small class sizes, individualized attention, personalized social settings, and an atmosphere of familiarity. Extracurricular participation rates and academic achievement are higher and dropout rates and incidents of violence lower at small schools than in "big-box" institutions. Educators and administrators have also come to realize that in many urban environments the construction of large campuses is neither physically possible nor economically feasible. Some states, such as Maryland, Pennsylvania, and North Carolina, have revised their school construction guidelines, eliminating school acreage requirements to achieve smart growth benefits and allowing each community to establish its own appropriate facility citing standards.

Proponents of new school construction argue that rehabilitating older and historic schools to meet current educational programming and standards is often impractical and simply not cost-effective. They point out that many older and historic schools lack facilities such parking, air-conditioning, athletic fields, and flexible interior spaces that teachers, parents, and students expect and that are needed to accommodate the special programs that have proliferated in schools. They claim older buildings cannot accommodate the new technologies in the classroom. While it is true some older and historic schools are in extremely poor physical condition and do not meet present educational requirements, the question is not whether they can work as modern facilities in their present shape but whether they can be rehabilitated to meet current educational and community needs in an efficient, cost-effective manner. Architects and educational planners have overcome many of the perceived barriers to rehabilitation of older and historic schools and shown that renovated schools provide stable, attractive, and cost-effective educational environments. The continued abandonment of our older and historic schools now seems to reflect not reality but a bias toward new construction and reliance on outdated prescriptive guidelines for educational facilities that disengage education from other aspects of community life.

School districts must consider a number of factors when considering the rehabilitation of an older or historic school. These factors include, but are not limited to, the physical condition of existing building systems, facility compliance with current building, energy, and accessibility codes, site acreage requirements, sustainability, and cost. Moreover, these factors must be considered in light of the district's facility master plan and educational program. The *Primer* briefly discusses each of these factors, focusing on those issues that in the past have served as barriers to the rehabilitation of these schools. Case studies are used to illustrate how communities across the United States and Canada have successfully renovated older and historic schools to save both valuable community assets and construction dollars. The *Primer* is intended as a companion piece to CEFPI's *Appraisal Guide for Older and Historic Schools* to assist school administrators, educators, and the general public in evaluating the physical condition and educational adequacy of their older and historic schools.

Terms such as restoration, renovation, and rehabilitation have for decades been applied to modest and major school construction work undertaken with limited resources and in response to some crisis. We should stress that while the terminology is drawn from well established and codified sources, that is not this report's point of view. Instead, we intend to discuss the substantial and comprehensive improvement of existing schools. This process is very different from major maintenance work or mere Band-Aids intended to help an old school serve additional years. The goal of rehabilitating (or any of the "re" words used here) an older or historic school, as presented here, is to establish a facility equal in service life, capacity, amenity, and program to a new twenty-first-century school. Anything less would not generate the "apples-to-apples" comparison necessary to make informed decisions on the merits of older and historic schools.

Terminology

The terminology used in describing the treatment of older and historic school buildings can be confusing. Many terms are used interchangeably, and some are defined differently by various national and state building and fire safety codes. Within the national building codes, historic buildings are treated as a special subset of existing structures. The terminology used in describing the treatment of historic buildings is quite clear and exact, and terms are more narrowly defined because a consistent set of federal guidelines, the *Secretary of Interior's Standards for the Treatment of Historic Properties*, apply. A number of the terms used to describe the treatment of older and historic schools are defined below. For the purposes of this document, the definitions developed by the International Code Council (ICC) will be used wherever possible and indicated as such. Additional explanation will be given if the meaning of the term is different as it applies to historic buildings.

Adaptive reuse. The reuse of a building or structure for a purpose different from the original one. The term implies that certain structural or design changes have been made to the building so it will function in its new use.

Springdale Public Schools Administration
(courtesy of Hight-Jackson Associates)

Old Springdale High School was built in 1910 and is the oldest surviving school in Arkansas. This eight-room brick schoolhouse served as a junior high and then as a grade school until the late 1980s, when it was abandoned. At the time, the school district could not justify spending tax dollars for the renovation of the facility. Vacant until 1994, it was destined for demolition until several local benefactors urged examining the feasibility of renovating the building as a school or for some other purpose. With the help of donations from alumni and other supporters as well as proceeds from the sale of the district's then-current administrative offices, sufficient funds were raised for the renovation of the structure as the district's new administrative offices. Through careful planning, much of the original interior was preserved, retaining the building's historic atmosphere. The building houses the school district superintendent and four assistant superintendents, along with support staff, central bookkeeping functions, and file storage. The original auditorium was renovated to provide meeting space for the public and school board. Project Architects: **Hight Jackson Associates Architects & Planners**

Addition. An extension or increase in floor area, number of stories, or height of a building or structure (ICC).

Alteration. Any construction or renovation to an existing structure other than repair or addition (ICC).

Change of occupancy. A change in the purpose or level of activity within a building that involves a change in application of the requirements of the code (ICC).

Code official. The officer or other designated authority charged with the administration and enforcement of the building code or a duly authorized representative.

Compliance alternative. Any means of reasonably meeting the intent of a specific code provision.

Conversion. Any major change in the use of a facility (see adaptive use).

Western Technical Commercial School was initially constructed in 1927 as a technical school. After many additions, the Tudor Revival high school became the largest school building in the Commonwealth, at about 435,000-square-feet. As the surrounding residential neighborhood aged, student enrollment dropped. To maintain efficient use of the space, the building was converted in 2002 into three distinctive high schools offering a diverse range of programs. Clearly defined contiguous space was created for the **Ursula Franklin Academy, THESTUDENTSCHOOL,** and for the **Western Technical School.** Each high school has a clearly articulated character, a separate entrance, and specific school colors (green, blue and red) to distinguish its spaces and facilities. Project Architects: **ATA Architects, Inc.**

Western Technical & Commercial School Animation Lab (courtesy of ATA Architects)

Ursula Franklin Academy Library after conversion (*courtesy of* ATA *Architects*)

Equivalency. An alternative means of providing safety greater than or equal to that afforded by strict conformance to specification standards.

Existing building. A building erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued (ICC).

Historic building. Any building or structure that is (a) listed in the State or National Register of Historic Places, (b) designated as a historic property under local or state designation, law or survey, (c) certified as a contributing resource within a National Register listed or locally designated historic district, or (d) with an opinion or certification that the property is eligible to be listed in the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places (ICC).

Older building. The ICC does not use or define the term *older*. Instead, it refers to "existing buildings." For the purposes of this document, *older schools* refers to schools that are 50 years or older and not listed on the National Register of Historic Places or designated a historic building under state or local law. This is a purely arbitrary distinction generally adopted by the historic preservation community, and it is one of the threshold considerations for listing on the National Register of Historic Places.

Preservation. The act or process of applying measures necessary to sustain the existing form, integrity, and materials of a historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project (*Secretary of the Interior's Standards for the Treatment of Historic Properties*; *Weeks and Grimmer* 1995).

THESTUDENTSCHOOL (*courtesy of* ATA *Architects*)

Prevailing code. The most current edition of the adopted building or fire safety code that applies to a technical component.

Rehabilitation. The act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features, which convey its historical, cultural, or architectural values. Rehabilitation acknowledges the need to alter or add to a historic property to meet continuing or changing uses while retaining the property's historic character (*Secretary of the Interior's Standards for the Treatment of Historic Properties*; *Weeks and Grimmer* 1995). The ICC defines rehabilitation as any work undertaken in an existing building.

Reconstruction. The act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location (*Secretary of the Interior's Standards for the Treatment of Historic Properties*; *Weeks and Grimmer* 1995).

Restoration. The act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project (*Secretary of the Interior's Standards for the Treatment of Historic Properties*; *Weeks and Grimmer* 1995).

Renovation. Any work undertaken in an existing building to restore it to good condition, operation, or capacity. Renovation is not defined by the ICC or by the Secretary of Interior Standards.

Repair. The restoration to good or sound condition of any part of an existing building for the purpose of its maintenance (ICC).

Seismic retrofit. The reinforcement of buildings to better withstand earthquakes.

Stabilization. The act of undertaking repairs necessary to inhibit the further deterioration of a structure.

Historic Designation

The difference between the terms *older* and *historic* is significant because it dictates how existing building codes are enforced and if protection against alteration or demolition is afforded by local, state or federal legislation. To be considered "historic" a school must be:

- listed, or certified as eligible for listing, on the National Register of Historic Places, or as a contributing building within a National Register listed historic district; or

- listed, or certified as eligible for listing, as a historic landmark by a local or state government, or as a contributing building within a locally designated historic district.

National Register of Historic Places

The National Register of Historic Places is America's official list of cultural resources deemed worthy of preservation by the federal government (U.S. Department of the Interior, National Park Service 2003a). It was created for the purpose of identifying and protecting cultural resources of historic significance including buildings, sites, monuments, and objects. The National Register program is administered by the National Park Service in partnership with state governments. At present more than 2,700 schools are listed on the National Register, though many of these structures no longer function as schools but instead serve as offices, apartments, and retail outlets.

Properties may be nominated to the National Register because of their significance to the nation, state, or community. Nominated properties are evaluated according to a uniform set of criteria. In general, only those properties that are at least fifty years old are eligible for listing on the National Register. A property may be nominated for inclusion on the National Register because of its association with a particular event or person who made a significant contribution to American history, architecture, archaeology, engineering, and culture. A property may also be nominated because it characterizes a particular type, period, or method of construction or possesses great artistic value.

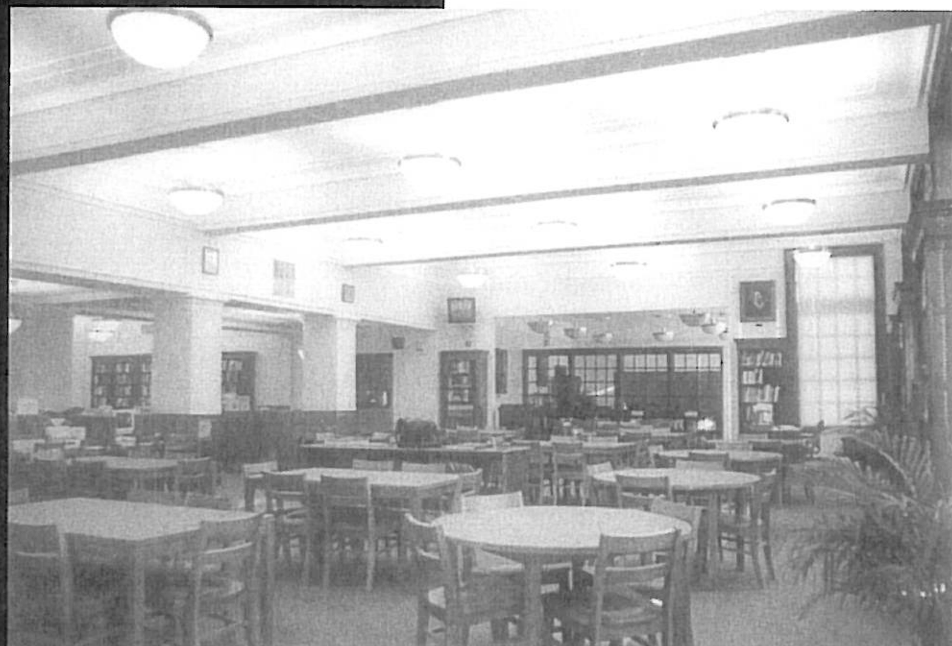
Listing on the National Register serves primarily to recognize and honor historic merit. It does not restrict the owner from demolishing or altering the property in any way, unless federal funds are to be used for this purpose. Section 106 of the National Historic Preservation Act of 1966 requires that federal agencies allow the National Park Service (NPS), acting through the State Historic Preservation Office (SHPO) in each state, to review all undertakings involving federal expenditures or licensing to identify adverse effects on historic sites. If an adverse effect is found, it is typically eliminated by stopping or changing the planned project, or mitigated through some negotiated agreement. In cases where the federal agency, the NPS, and SHPO cannot agree, the Advisory Council on Historic Preservation,

R.J. Reynolds High School in Winston-Salem, North Carolina, is a local historic landmark and is listed on the National Register of Historic Places. Built in 1923, this four-story, 105,000-square-foot building is an outstanding example of neo-classical revival architecture. It remained virtually unaltered for seventy years, until it underwent rehabilitation in 1993. At this time, the mechanical, electrical, communication and fire safety systems were upgraded, and classroom sizes were increased to meet current educational standards.

In addition to desiring to restore the school to its original splendor, the school district required a large media center and additional classrooms. The existing library was too small to be used as a modern media center for the student body of about 1,300. School officials initially considered constructing an additional building on campus to house a new media center and possibly some other ancillary spaces. Relocating the library, however, presented a number of concerns. The library was extremely well preserved and possessed many original architectural elements. In addition, its current location in the central core of the classroom building was ideal. After evaluating the entire campus for possible locations for an addition, the architect determined that the additional space required by the school district could be obtained without harming the historic integrity of the building and site by using sections of two, large interior courtyards. Reducing the width of the two existing courtyards by fifteen feet while enclosing the center corridor off the main entrance created the additional space needed for the expanded and modernized library.

The library's rich detail was maintained and was matched in the new media center. The original plaster beam casings, crown molding, raised panel wainscoting, and wood trim were carried into the expanded space. The original woodwork, including the library shelves, were chemically stripped and refinished. Pendant lights were hung in a pattern reflecting the stern symmetry of the room.

The creation of an expanded media center also allowed additional classrooms to be constructed within the building's footprint. Reducing the width of the inner courtyards created additional space on all three floors for a guidance counselor suite (first floor) and a cluster of business classrooms (third floor). Project Architect: **Ersoy & Associates, P.A.**



Expanded library and media center at R.J. Reynolds High School following renovation
(courtesy of Ersoy & Associates)

appointed by the President, will resolve the dispute. Some states have similar laws requiring review by SHPO for projects funded or financed by state tax dollars.

State Historic Registers

Most states maintain an official list of properties deemed important to local, regional, or national history. Often states use the same eligibility criteria as the National Register of Historic Places to evaluate resources for inclusion in their historic registers. Nominated or listed properties receive a measure of protection when a state agency funds, licenses, or permits an activity that may affect the property. Typically, the impact is reviewed by a separate state agency and may include local governments in the consultation process. Work permits, for example, may be denied for projects determined to have an adverse effect on the property, though this can be avoided through early planning and coordination with the state agency.

The State of Maryland is unique in that state law requires all public schools be reviewed by the Maryland Historic Trust to determine if they are eligible for listing on the state register of historic properties

Lake Worth High School is one of Palm Beach County's most significant school structures, with its buildings dating from the early 1920s. It is on the state's inventory of historically significant properties and is eligible for listing on the National Register of Historic Places. Throughout its history, the campus has had many additions to accommodate increases in population. A Master Plan developed by Fanning/Howey Associates, Inc., rectified this disorganized growth, and rehabilitated the decaying buildings. The first phase consisted of construction of a new cafeteria and classroom building, providing new infrastructure for this and future phases, while renovating the two most deteriorated, historically significant structures: the original high school (circa 1922), and the junior high originally built in 1925. By working closely with the Florida's Bureau of Historic Preservation, planners documented and restored much of the original Mediterranean design of the two buildings, while unobtrusively correcting deficient HVAC and electrical systems, roofing, handicapped accessibility, and code requirements. Architects: **Fanning/ Howey Associates, Inc.**

before state funds can be approved for renovation or demolition. If a school is found to be eligible for listing, the Maryland Historic Trust may require the school district to submit a cost comparison between rehabilitation and new construction, including the cost of demolition of the existing structure. Provided a good faith effort has been made to keep the school and all possible alternatives have been explored and exhausted, demolition may proceed if an appropriate mitigation plan is submitted and accepted. Such a plan may involve the complete documentation of a structure and strategies for salvaging and reusing its significant architectural elements.

Main entry to Lake Worth High School after renovation (courtesy of Emory Photography)

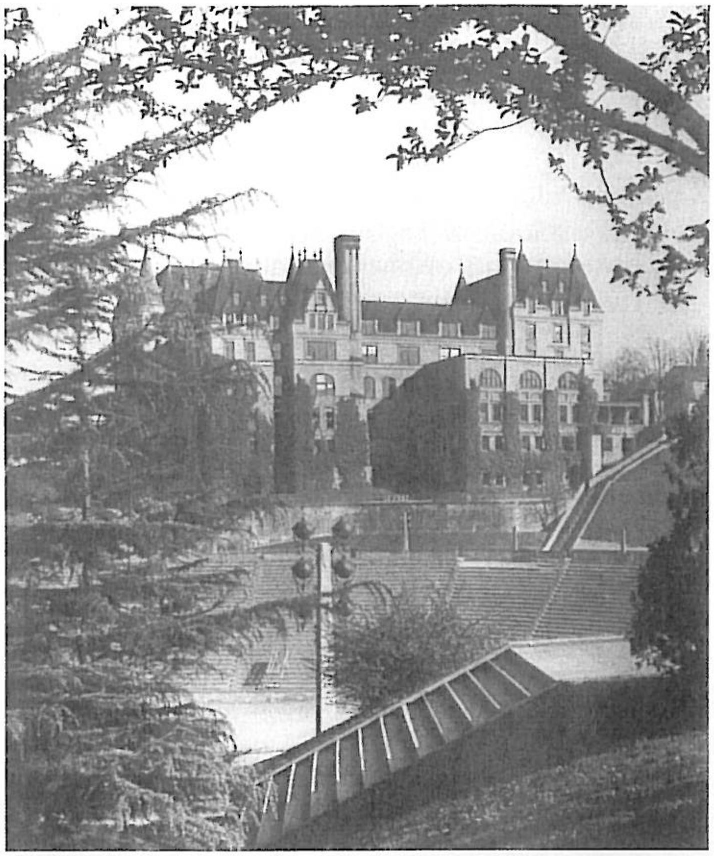
National Historic Landmarks

Included in the National Register, but relatively few in number, are National Historic Landmarks (U.S. Department of the Interior, National Park Service, 2003b). To be designated a National Historic Landmark, a property must possess exceptional value or integrity in reflecting the cultural heritage of the United States. Once designated a National Historic Landmark, a property is automatically placed in the National Register of Historic Places. The National Park Service, using similar preparation, review, and evaluation procedures as National Register nomination, also administers the National Historic Landmark program. Properties achieve this designation only if they possess national significance.

Local Historic Landmarks and Districts

Local landmarks and districts are recommended for designation by historic preservation commissions established by local governments. If approved, designation is made by local ordinance. Guidelines and procedures vary from state to state. Communities may designate local landmarks and districts that are not listed on the National Register, though it is quite common for local preservation commissions to use National Register nomination as a basis for designation or to apply National Register criteria for evaluating local landmarks and districts. Thus, a school may be designated historic by a local or state historic preservation

Stadium High School has been a source of community pride for Tacoma, Washington, for almost 100 years. Listed on the City of Tacoma's register of local historic landmarks, it is an important part of the Stadium-Seminary Historic District, a National Register historic district. The building was originally built by the Northern Pacific Railroad Company and Tacoma Land Company as a hotel and was modeled after a chateau in Tours, France. Construction stopped in 1893 in the wake of a nationwide financial panic and depression. In 1904, the unfinished structure was converted into Tacoma High School, later renamed Stadium High School in honor of its new football stadium (The Bowl), which for decades served as a forum for many important public events. Since then, the school has undergone many renovations to address the evolving educational needs of the students and community, despite calls by various groups to abandon the school. On each occasion, the community and alumni rallied to raise funds to perform the necessary repairs and upgrades to keep the school in service.



Exterior view of Stadium High School with Bowl in foreground (circa 1977)
(courtesy of Stan Fillips)

commission but may not be eligible for listing on the National Register.

Owners of local landmarks and properties in historic districts are generally required to obtain permits from their local preservation commissions before making significant alterations or changes to a property. In the event of a proposed demolition, local commissions may explore alternatives, such as relocation. This process may delay demolition. If a satisfactory alternative cannot be reached, demolition can proceed. In some states and communities, demolition cannot proceed under any conditions if the local landmarks commission or the State Historic Preservation Officer determines the property has sufficient significance. For this reason, school boards often discourage historic designation of older schools, for fear of losing control over how these facilities can be used in the future.

Secretary of Interior Standards for the Treatment of Historic Properties

The Secretary of the Interior's office has established professional standards for the treatment of properties listed, or eligible for listing, on the National Register. *The Secretary of the Interior's Standards for the Treatment of Historic Properties* (Weeks and Grimmer 1995; Heritage Preservation

The following standards apply to the rehabilitation of historic buildings:

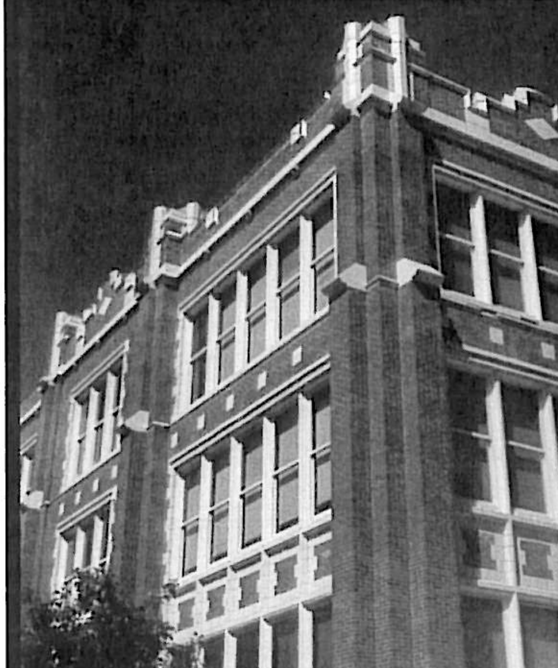
1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.
2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.
3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.
4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.
5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.
6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.
7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.
8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.
9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.
10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired. (Weeks and Grimmer 1995, p)

Services 2003) provide a philosophical framework for the responsible treatment of historic properties. The standards address four different approaches to treatment: *Preservation, Rehabilitation, Restoration, and Reconstruction*. The most commonly applied approach to the treatment of historic schools involves rehabilitation. Rehabilitation allows for repairs, alterations, and additions to be undertaken while preserving those aspects of the property that convey its historical, cultural, or architectural values.

The *Standards* are sometimes perceived as a barrier to the rehabilitation of historic schools, because of the widespread belief that the entire structure must be completely restored to its original form and function. This is a misconception. The *Standards* call only for the retention of character-defining architectural features. They encourage alterations and additions to facilitate the continued use of the structure. Character-defining features are distinctive qualities or aspects of a building that contribute significantly to its overall physical appearance and presence. These features may include interior features, such as decorative finishes and details, stairways and moldings, and exterior features, such as roofs, windows, and interior and exterior doors. Spatial relationships and room configurations as

Situated within the city's central business district, **Lewis and Clark High School** has long been the pride of Spokane, Washington. Built in 1912 and listed on the National Register of Historic Places, the school was beginning to show its age by the 1990s. Though well maintained, many of the building systems, including the school's electrical and plumbing systems, were antiquated and needed replacing. The rehabilitation of Lewis and Clark High School posed many challenges, such as inadequate science and athletic facilities, small classrooms that did not meet state guidelines, and noncompliance with current building codes. The design team at **Northwest Architectural Company** formulated a nineteen-point plan to identify the school's many character-defining features. These included the school's exterior masonry and terra cotta, exterior granite foundation and steps, perimeter stone retaining walls, windows, exterior doors, the 1908 Administration Building, clock tower, vaulted main entry foyer and marble staircase, man entry hallway, terrazzo floors, high ceilings, interior doors and trim, wood floors, interior staircases and loop circulation system, auditorium, toilet rooms, art collection, casework, and book room. Through public forums and discussions with the City/County Historic Landmarks Commission, community members and planners identified these features. An advisory committee guided historic preservation and other planning considerations. The goal was to retain distinctive materials, features, spaces, and spatial relationships deemed important to the historic integrity of the building and site. The breadth and scope of the character-defining features required the preservation plan to include elements of preservation, reconstruction, restoration, and rehabilitation.

Main exterior of Lewis and Clark High School before renovation (courtesy of Northwest Architectural Company)



Main exterior Lewis and Clark High School after renovation (courtesy of Northwest Architectural Company)

The decision to replace the original school windows was made only after much thought and consideration. New windows were required for several reasons: the existing window sashes were rotting on the south and west, due to heavy exposures where metal strap angles hold together the corner joinery; the existing windows were not sealed sufficiently for energy conservation, nor could they be sealed as effectively as factory-fabricated windows; and the existing windows did not have enough sash depth to accommodate triple glazing, which was essential both for energy conservation and acoustical isolation from perimeter freeway noise and street traffic. After reviewing the new windows and their effect on the interior and exterior trim and tracery, the advisory committee decided to install new aluminum-clad, triple-glazed, monumental windows. The cladding on the outside of the window echoed the existing trim and sash. All of the molding's tracery and arrises were also duplicated. The windows were finished in an ivory color consistent with 1930s vintage color postcards, which depict the original building with similar frames. Architects: **Northwest Architectural Company.**

well as various building systems may also be character-defining features, though this is rare. When the standards have prohibited rehabilitation, it is primarily a consequence of an overly conservative interpretation of the standards.

Exterior windows are one of the most important character-defining features of historic schools and oversight committees or regulatory agencies frequently oppose their removal or replacement as destruction of historic fabric. Yet, architects often recommend removal or replacement, arguing that their poor insulating properties make them a major source of energy loss in older buildings and that removal of lead-based paint from wood members can be very expensive. Any decision to replace these windows with a more energy-efficient glazing system should be based on a thorough energy analysis of the thermal performance of the existing glazing system. In the case of intermittently heated or cooled buildings, the energy savings may be minimal. High-quality interior or exterior storm windows may improve the thermal performance of the windows, although such systems may detract from the exterior appearance of the school. Whenever possible and economically feasible, existing windows should be refurbished and reinstalled. As a last resort, new windows should mimic the original configuration of stiles, mullions, and muntins.

The *Standards* must be applied when federal funds are used in the rehabilitation of an historic school. However, schools typically do not receive federal dollars for construction. Many local and state governments, however, have adopted the *Standards* as a guide for all work undertaken on properties designated at the local or state level as historic. Under these conditions, the State Historic Preservation Officer may review the architectural plans in light of the standards to ensure the historic integrity of the structure is not compromised.

Facility Planning

The decision to rehabilitate an older or historic school should take place within the context of the school district's facilities master plan, which determines the extent of capital projects and available financing methods. A facilities master plan is a document that describes the process by which school facilities are planned, built, and evaluated. Its purpose is to accommodate and support current and future educational programs.

A facilities master plan typically contains five elements: (1) a description of the educational program; (2) an analysis of the local community and its relationship to the school district; (3) an assessment of the student population, including projected enrollment; (4) an appraisal of the educational adequacy and physical condition of existing school facilities; and (5) an assessment of the financial resources available to the school district. With this information, the master facility plan can be used to develop and assess various alternatives to meet educational and programmatic goals, and to formulate specific recommendations.

The educational program is the heart of the facilities master plan and drives the entire planning process. It describes the districts educational philosophy, goals and objectives as well as strategies to achieve specific outcomes. It also addresses organizational and staffing issues and curriculum offerings. The educational program directly impacts facility planning because it specifies programs and activities that must be translated into architectural spaces and relationships.

Understanding the community served by the school is critical to facility planning. This is particularly true for older and historic schools, which are often intimately connected to their neighborhood and reflect community pride and aspirations. Many urban schools, however, have experienced significant declines in school enrollment because of changing demographics and social trends. Others, because of urban flight to the suburbs, serve a transformed community that has no historical connection to the original school. Many factors are important to learning about a given school's community, including its demographics, the socio-economic status of the population's various groups, the availability of community services, vocational opportunities, parental expectations, and involvement.

Projecting future student enrollment is critical to anticipating the need for new school construction or rehabilitation of existing facilities. In booming suburbs, population growth creates demands for new classrooms, while in many rural areas, decreased student enrollment has reconfigured school districts, closed smaller schools, and consolidated student bodies on larger campuses. Though student enrollment is strongly associated with community demographics, other factors such as changes in school district boundaries and immigration are important and must be assessed.

A facilities master plan must also include an assessment of the physical condition of the school district's educational facilities and of their ability to accommodate the desired educational program. Not surprisingly, older and historic schools have appraised poorly when assessed against criteria that emphasize specific minimum acreage requirements or other prescribed standards more relevant to new construction. CEFPI has developed an assessment process and appraisal tool for evaluating older and historic schools. The process allows school districts and individual schools the opportunity to resolve deficiencies in older and historic schools by developing and employing strategies that take advantage of community resources, partnerships, and other cost-sharing measures. By tying the appraisal process to the educational program, school districts may also assess the use of older and historic schools as alternative schools, such as special program schools (language, technical, math, science, arts, intensive learning), magnet schools, and resource centers, or as schools with a reconfigured grade organization. This approach to assessment maximizes the potential utility of older and historic schools without sacrificing educational adequacy.

A facilities master plan should also include an assessment of the financial resources available to the district and an estimate of the cost of capital improvements or new construction. Historically, schools have been funded through local property taxes and municipal bond issues, although in recent years alternative funding sources and mechanisms have been developed to address inequities in school facilities among districts. The facilities master plan must reconcile the cost of facility improvements and capital expenditures with the financial resources available to the district—both in the short-term and the long-term.

Landon Middle School auditorium before renovation
(courtesy of Cannon Design)

Landon Middle School auditorium after renovation (courtesy of Cannon Design)

Landon Middle School in Jacksonville, Florida, was built in 1926 in the Mediterranean Revival style. The main building is a three-story structure built around a central courtyard. Before renovation in 2001, the Landon Middle School was a magnet school for the arts. When funding became available to build a new middle school for the arts, the school board decided to convert the school to a middle school in the existing historic neighborhood. The neighborhood needed a middle school, but the prohibitively high cost of undeveloped property in the historic neighborhood ruled out new construction. The building was structurally sound and could be redesigned to accommodate an additional 300 students (student enrollment prior to rehabilitation was 900). Initial estimates for rehabilitating the structure were also much less than the cost of building a new school. Rehabilitation of the 100,000-square-foot school entailed asbestos abatement and demolition of interior construction and systems; all new mechanical and electrical systems and infrastructure, including a new fire protection sprinkler system; ramps and an elevator to meet ADA requirements; sensitive upgrades to stair railings to meet new life safety code requirements; computer connectivity in all classrooms; and a new administrative suite, media center, science laboratories, and computer labs. Project Architects: **Cannon Design.**

In formulating specific recommendations, the facilities master plan synthesizes all the above information and reconciles educational facility needs with available financial resources. Planners must consider the feasibility of various alternative solutions to meeting current and future educational and programmatic need. Final recommendations specify the need for new construction, rehabilitation, or abandonment of existing facilities.

Facility Programming

The first stage in the school design process, facility programming forms the foundation for subsequent planning, budgeting, design, and construction. In an effort to determine the needs and requirements for the building, planners must identify the community's values, beliefs, and vision; define the project's goals and

Main exterior of Las Vegas High School exhibiting original architectural elements
(courtesy of Tate Snyder Kimsey Architects)

The Las Vegas Academy of Performing Arts and Foreign Languages and International Studies, formerly Las Vegas High School, is planning a new performing arts complex to include a theater and visual arts building. As part of this development project, a study was commissioned to provide a framework for the eventual rehabilitation of the historic structures located on the site. The study examined the physical condition of the building fabric, identified significant historic elements, and offered suggestions for remedying deterioration. The study also addressed issues of handicapped accessibility in light of the potential impact on the aesthetic integrity of the buildings.

Las Vegas High School was converted to a performing arts school in 1992. This decision was prompted by a number of factors, one of which was its location. Constructed at what was once the edge of town, the high school now stands in the heart of the downtown area, far removed from areas of the city experiencing rapid growth. Strong alumni support ensured that closure was never a possibility, and Las Vegas High School's conversion to a performing arts school proved enormously successful. The school has become the premier magnet school in Las Vegas, with more than 1,700 students. It has won many awards and has twice been named a blue-ribbon school.

The Las Vegas Academy site consists of several buildings, of which two, the Academic Building and the Gymnasium, are listed on the National Register of Historic Places. Three other buildings, Frazier Hall, Sunset, and the Vocational Education Building, are listed as contributing buildings and are potentially eligible for listing. The five concrete structures were built during the 1930s and 1940s and reflect a mix of Art Deco and Art Nouveau styles. The Academic Building and Gymnasium were constructed concurrently and share similar design features and elements, while the remaining buildings were constructed at a later date, and reflect a simpler architectural design.

Scrollwork on façade of Las Vegas High School
(courtesy of Tate Snyder Kimsey Architects)

The historic appearance and integrity of the buildings are largely intact. Building exteriors have undergone only a few minor changes that detract from their historic appearance. The well preserved facades of the Academic Building and Gymnasium retain original architectural elements, including the cast stone ornamentation. Minor alterations to the exterior of the Academic Building include the addition of an exterior stair and bridge on the building's south side and rendering the multi-light metal sash windows inoperable. Restoration of the original surface and trim colors to an Art Deco appearance has been recommended as a means of highlighting the historic character of the building. The Gymnasium's exterior is intact, although the windows have been filled in and stuccoed, yielding an otherwise acceptable appearance. The study has recommended relocating the ticket booth, now situated at the entrance to the gymnasium, because it detracts from the building's overall appearance. Frazier Hall and the Vocational Education Building, on the other hand, have been subjected to intrusive exterior treatments, although they still retain significant primary elements and could easily be restored. These include a poorly designed handicapped ramp at the main entrance to the building that does not complement the building's architecture and expanded metal sunscreens inappropriate for the character of the building.

All building interiors have been subjected to extensive remodeling over the years, and only remnants of original architectural fabric remained. Evidence of original architectural elements has been found in the library of the Academic Building. At the edge of the suspended ceiling, portions of the ornamental brackets and beams of the original plaster ceiling could be seen; suggesting that the original plaster ceiling may be hidden above the lower ceiling installed to hide the air conditioning ducts. The study has recommended consulting an engineer to devise a way to air condition the library without the need for a suspended ceiling. Project Architect: **Tate Synder Kimsey Architect; Melvyn Green & Associates.**

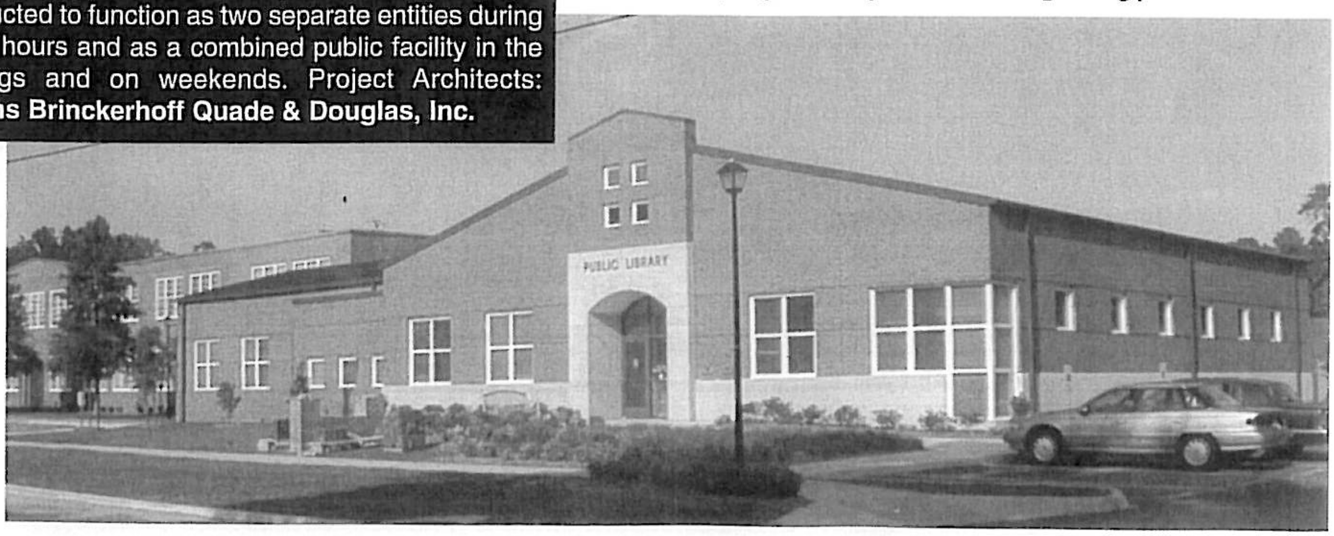
objectives; and articulate the design criteria. Some of this information may be found in the school district's facility master plan and educational plan. However, to begin the design process for a rehabilitation project, the architectural team often needs more detailed information about the specific facility. This is particularly true for older schools where the configuration and physical condition of each of the building's systems is critical to design and cost analysis. To identify character-defining features and understand the school's historic significance, designers may consult the original nomination documents submitted to local landmarks or historic preservation commission, the state historic preservation office, or the National Park Service. Additional documentation may be obtained from local heritage or history commissions, planning offices, neighborhood or preservation organizations. In the absence of sufficient documentation, a preservation consultant may be commissioned to prepare a historic structures report to identify historically significant and character-defining features, to describe the condition of the structure's interior and exterior, and to identify additions or alterations to the original structure.

The retention of historically significant interior features can be challenging when renovating older or historic schools. Older schools may have irreplaceable interior detailing and finishes and high quality craftsmanship that can no longer be reproduced. While saving these features must be balanced with life safety and educational program needs, preserving them should always receive serious consideration.

Older and historic schools have often spouted many additions as their needs evolved through the Baby Boom period. Such additions are rarely consistent with the original building's design and massing, and they often detract from the school's appearance. Often, they are obstacles to providing proper handicapped accessibility. These non-historic additions are commonly demolished to make way for more sympathetic new construction. Decisions of this nature require a thorough assessment of precisely what architectural elements contribute to the historic or cultural significance of the original school.

Successful facility programming depends on understanding the relationship between the school district and the surrounding community. The community must participate in the programming and planning process to help articulate the school or district's educational plan and to identify the need for public access to school facilities. Many older and historic schools are centers of their community and enjoy strong community support. That very commitment may lead to intense emotional discussions, and many meetings may be needed for everyone to agree upon an acceptable process for modifying or reusing a school facility. Today, many school districts are entering into partnerships with neighboring institutions, local businesses, and government agencies to share resources such as public libraries and athletic facilities and parking. These partnerships reduce operational costs and capital expenditures and provide opportunities for innovative educational programming. Decisions regarding public access to

Originally built in 1939 as a WPA project, **Creeds Elementary School** (Virginia Beach, Virginia) became a focal point of its rural community. Renovation of the school in 2001 provided an opportunity to take advantage of the close working relationship that existed between the school and the adjacent branch of the city public library. With suggestions from the community and from school and public library staff, a library-media center was constructed to function as two separate entities during school hours and as a combined public facility in the evenings and on weekends. Project Architects: **Parsons Brinckerhoff Quade & Douglas, Inc.**



Creeds Elementary School after renovation (courtesy David Sailors, Parsons Brinckerhoff Quade & Douglas) schools and the sharing of public resources have significant implications for school design and must be fully developed during the facility programming process.

The architectural programmer may work independently or together with the architect or designer, and the programming and design process may occur simultaneously or separately. During the programming process, the programmer seeks to build consensus and to stimulate and organize the decision-making process by helping the school district to define project needs and by establishing and testing concepts to meet these needs. Generally, users must balance needs against expenses and set priorities accordingly. The process culminates in a final problem statement, which is then presented to the district in written form for confirmation and review. Documenting this agreement can be very important to the continued success of the project.

Funding of Older and Historic Schools

Until recently, most school construction and renovation projects were funded through general obligation bonds backed by local property tax revenue (Sandham 2001). Because the tax base may vary significantly from district to district, reliance on local property tax revenue often led to inequities in school funding between richer and poorer school districts (Brunner and Rueben 2001). To close the equity gap, many states now play a greater role in financing capital projects (Morgan 2002). Most states have developed annual funding programs to address their school districts' capital needs. In addition, some states issue bonds in the name of the school district or allow districts to borrow money from the state for capital improvements. To reduce the cost of borrowing, some states have developed credit enhancement programs that guarantee local general obligation bonds. Capital improvements in some states are also supplemented or funded by lottery revenue, matching grants, and other state appropriations.

The growth of state funding mechanisms has prompted state oversight agencies to develop and apply statewide design standards for school construction. State funding criteria governing the approval of school construction subsidies that are biased toward new construction can be a significant barrier to the rehabilitation of older and historic schools. In some states, financial assistance is available for rehabilitation or renovation projects, but only if the cost of rehabilitation does not exceed a certain threshold relative to new construction. Some states have used a 50 percent, 60 percent, or two-thirds rule when comparing these costs. Such rules are arbitrary, for there is no evidence to show that a well-renovated school has any less value than wholly new construction (Yeater 2003). In 2002, the Ohio School Facilities Commission responded to a grassroots campaign by Ohio urban school districts and state and national preservation organizations by agreeing to waive compliance with its guidelines for appropriating state funds for capital expenditures. These guidelines required building a new school if the cost of rehabilitation of an existing school exceeded two-thirds the cost of new construction (Cincinnati Preservation Association, 2003). Local school boards may now appeal to the Ohio School Facilities Commission for a waiver on a case-by-case basis, and many are doing so. In 2002, Pennsylvania eliminated its percentage rule. Similarly, Maryland encourages the renovation of schools as the first option and will fund renovation projects for entire schools that are forty years of age or older even when the budget is based on 100 percent of the cost of new construction.

The federal government has traditionally played only a limited role in financing capital projects in public schools, and with rare exceptions, no capital funding from the federal government is currently available to assist with school renovation or new construction. The major financial incentive encouraging historic rehabilitation is the Federal Historic Preservation Tax Incentive program, designed to stimulate private sector investment in the rehabilitation of historic buildings (U.S. Department of the Interior, National Park Service (2003c). Under this program, a tax credit equal to 20 percent of the cost of a qualified historic rehabilitation is available to investors in income-producing properties formally listed as historic buildings at the local, state, or national level and approved by the NPS as complying with the Secretary of the Interior's Standards for the Rehabilitation of Historic Property. Many states have similar programs related to state income tax credits. State and federal historic tax credits have traditionally been used for the adaptive use of abandoned schools when sold for conversion to income-producing property. Recently, however, a number of historic schools have been rehabilitated through creative public-private partnerships that have taken advantage of state and federal tax credits by syndicating the credits to private investors. Private academies, parochial schools, and some charter schools have also taken advantage of historic tax credits.

Governor's School commons area (court-yard) before renovation
(courtesy of BCWH Architects)

The **Governor's School for Government and International Studies (GSGIS)** in Richmond, Virginia, is a comprehensive high school for gifted and talented students with an interest in world cultures and languages. For a number of years after its founding in 1991, it shared a facility with a public high school in Richmond City. In 1999, to accommodate increased student enrollment, GSGIS rehabilitated Maggie Walker High School, an inner-city public school that had been abandoned ten years earlier. Maggie Walker High School, built in 1937 and expanded in 1962, was Richmond's first vocational high school for African-Americans. Listed on the National Register for Historic Places, the Maggie Walker High School was an architectural gem that had fallen into disrepair. In 1999, the city of Richmond transferred ownership of the property to the Governor's School Regional Board.

BCWH Architects and a partnership of public and private entities renovated the building for the Governor's School for Government and International Studies (GSGIS). The outcome is a good example of the development of a regional magnet school. Though costs were borne by public and private sources, including participating school districts, the project was made possible through the innovative use of state and federal preservation tax credits.

Governor's School commons area after renovation
(courtesy of BCWH Architects)

Tax credits were syndicated to offset the cost of rehabilitation. In this process, the owner of the historic property takes on one or more investment partners to create a new ownership entity, typically a limited partnership. The partners are often banks or large corporations that provide funding for the project in exchange for use of the tax credits. In the case of GSGIS, a for-profit entity, the Maggie L. Walker Renovation Foundation, was formed to manage the project officially. This Foundation served as the building owner and landlord. All private funds raised for financing the rehabilitation of the school were received by the foundation. This entity served as the managing partner of the limited partnership, Maggie L. Walker High School LLC, to use the tax credit. The syndication partners were identified by the developer, who provided funding for the project and used the tax credits. A historic preservation consultant completed the application for state and federal tax credits and worked with the owner and architect to make sure the project was eligible for the credits. Following rehabilitation, the Maggie L. Walker Renovation Foundation then leased the building for one dollar a year to the GSGIS Regional School Board.

The legal issues involved in establishing the limited partnership and defining the critical terms of ownership are complex. Moreover, a number of tax provisions affect the use of historic preservation tax credits when the rehabilitation involves properties used by governmental agencies, non-profit organizations, or other tax-exempt entities. In general, these properties are ineligible for the tax credit if the tax-exempt entity used the property before the sale or lease. The key to the successful use of the tax credits in this instance was the creation of a for-profit owner, which then leased the property to another entity entirely unrelated to the original owner. Project Architects: **BCWH Architects.**

Economics of Rehabilitation

School boards rely heavily on the total cost estimate when deciding whether to rehabilitate an older or historic school or to build a new one. While cost is certainly one factor in the decision, it should not always be foremost and should certainly not be the sole consideration. Nonetheless, economics play an important role, because a direct comparison of the cost of rehabilitation and new construction adds a degree of precision and clarity to the decision making process. For this reason, feasibility studies, which explore the programmatic potential, technical issues, design opportunities, and costs associated with rehabilitation, are critical in guiding the choice between renewal and replacement.

Determining the true cost of any capital construction project requires a long-term view evaluating and comparing all the costs and benefits of a given building project to a community and its quality of life. The total cost of facility ownership must take into account all expenses associated with the acquisition, financing, construction, operation and maintenance, and disposal of a facility (resale, demolition). In addition, various nonmonetary costs and benefits must be considered, whether they directly affect the project cost and the school's operating budget or are shifted to other government agencies. Nonmonetary costs or benefits, though difficult to quantify, are important. In the case of older and historic schools, it is hard to place a monetary value on a building's architectural or historic significance, or its importance to the identity of a local community. It is equally difficult to quantify the direct and indirect consequences of increased air pollution and traffic congestion associated with the construction of sprawl schools, and of the deterioration of property values in traditional neighborhoods resulting from school consolidation or relocation.

Economic Barriers to Rehabilitation

The commonly cited economic barriers to rehabilitation of older and historic schools generally manifest themselves as misconceptions about the actual cost of rehabilitation or benefits of new construction. They also frequently reflect inaccurate or incomplete estimates of the building project's costs. For example:

Rehabilitation is always more expensive than new construction

One widely held belief is that rehabilitating older/historic schools costs more than building a new school. The cost of rehabilitation and its comparison to new construction can be determined only on a case-by-case basis. It depends very much upon the completeness and accuracy of cost estimates and on the way costs are compared (cost per square foot or cost per student). Estimating the cost of rehabilitating an older or historic structure is generally more difficult than estimating the cost of new construction. Original architectural plans may be missing and structural damage may be hidden and only discovered once the project is underway. If detailed on-site investigations of the existing building are not performed during the initial design phase of the project, latent discoveries will result in costly change orders. Selecting an experienced architect or design team who can anticipate many of these hidden problems and adequately assign costs to different options can minimize these costs. Rehabilitation of older and historic schools frequently requires a slightly higher contingency allowance, a factor that should be reflected in the comparative analysis with new construction.

Failure to identify all costs when comparing rehabilitation and new construction can bias the results in favor of new construction. Often, preliminary cost estimates for new construction do not include the full range of costs associated with the project. These costs, which are significant, may be omitted because services are donated or because they are not considered capital expenditures, and are appropriated through different budgetary accounts. Hidden costs for new construction may include:

- Land acquisition costs
- Utility extensions and other infrastructure charges (permits, environmental testing, sewer fees, etc)
- Site development costs, particularly those often paid by municipalities or other units of government
- Furniture, fixture, and equipment costs
- Miscellaneous review fees related to environmental regulation
- Architectural, engineering, legal fees
- Fire protection charges related to sites outside municipal boundaries
- Capital and operating costs related to bussing
- Demolition, abatement of hazardous building materials, disposal of hazardous waste associated with abandonment of older schools
- Required roadway extension and improvements related to increased bus and parental traffic
- Extended water, sewer, electrical, and gas lines
- Risks related to the use of well and septic systems when public utilities are not available

Despite the omission of the above-mentioned costs, analysis of recent school projects in a number of cities across the United States has found the cost of rehabilitation to frequently be equal to, or less than new construction (National Trust for Historic Preservation 2000, 2003).

Small schools are not cost-effective and economies of scale can be realized through school consolidation

Many people believe older and historic schools are prohibitively expensive to operate because of their size. Many older schools are relatively small compared to current norms. Recent studies have identified a number of benefits associated with small schools, including greater parental and community involvement, increased student-teacher interaction, increased safety and security, and higher graduation rates (Barker and Gimp 1964; Cotton 2001; Lawrence et al 2002; Walsey 2000). Recent cost comparisons of small and large schools in New York and Nebraska focused on student performance, figuring the cost per graduating student. Viewed in that light, the apparent higher costs associated with operating small schools appear much lower (Funk and Bailey 1999; Steifel *et al* 1998). In the larger picture, long-term savings in the social costs of failures to graduate from high school drive down the operating cost of small schools even further.

Recent studies have also challenged the perceived cost savings of consolidation, noting that large schools actually create false economies (Lawrence *et al* 2002; Lee and Smith 1997; Cotton 2001; Coleman and La Rocque 1984). For example, larger schools theoretically should be less expensive to operate per student than smaller schools because the fixed operating cost can be spread out over more students. But in practice, larger schools often require more administrative, security and maintenance personnel and incur greater transportation costs associated with bussing students (Strange 2001). As a result, the expected savings from consolidating smaller schools is not realized.

Older and historic schools are prohibitively expensive to operate and maintain

Many public schools in the United States have suffered from years of deferred maintenance due to chronic funding shortages. At the same time, some school districts have intentionally underfunded maintenance of older schools that have been deemed inadequate and targeted for closure or demolition. Neglect of critical building components and systems not only increases the cost of rehabilitation, it gives school administrators the impression that older schools are unduly expensive to maintain and operate. To date, no evidence suggests that once renovated, older schools are more expensive to operate and maintain than newer schools. Once again, this can only be assessed on a case-by-case basis and depends very much on the nature and quality of the renovation. In reality, many older schools have proven cost-efficient to operate and maintain after they were retrofitted with modern mechanical and electrical systems, new windows and roofs, and other modern components.

Indirect costs are irrelevant

Often left out of the economic equation is the value of the existing asset and its economic importance to the community (Lyson 2001; Sederberg 1987; Petrovich and Ching 1977; Reeves 2004; Sell *et al* 1996). Demolishing an older or historic school may harm the local community economically. For example, loss of an important community institution may cause a decline in property values and thus decrease tax revenues for the school district and the municipality. The loss may also result in significant revenue losses for nearby stores and businesses. Neighborhood decline will eventually generate higher costs to taxpayers for social services, law enforcement, and community development. Conversely, renovating an historic school directly enhances the neighborhood and may serve as a catalyst for private investment by nearby homeowners and businesses.

While a new school building program is often cited as a generator of jobs in the community, the direct, indirect, and induced effects on local and state economies of rehabilitating historic properties far outweigh those generated by new construction. Rehabilitation of historic structures is labor-intensive, and labor is a local commodity. For every $1 million spent on rehabilitation, independent studies have shown that:

- About $120,000 more will initially stay in the community with rehabilitation than with new construction;
- Five to nine more construction jobs will be created;
- About five more new jobs will be created elsewhere in the community;

- Household incomes in the community will increase $107,000;
- Retail sales in the community will increase $142,000 as a result of that $1 million of rehabilitation expenditure, —$34,000 more than with $1 million of new construction; and real estate companies; and
- Lending institutions, personal service vendors, and eating and drinking establishments will all receive more monetary benefit from $1 million in rehabilitation than from $1 million of new construction. (Donovan 1994)

Simple mathematical formulas can be used to determine whether renovation or new construction is more cost-effective

No simple rule of thumb can show whether rehabilitation is cost-effective. Some school districts base their determination solely on the least expensive alternative. Many school districts, however, rely on funding formulas to provide guidance. Various formulas have been developed over the years and are widely employed in the school planning process to help school boards compare the costs of renovation and new construction. These often take the form of guidelines or standards specifying that if rehabilitation exceeds a certain percentage of the value of a building or the cost of new construction, rehabilitation is inappropriate. Although a definite percentage figure would make a convenient benchmark in deciding whether to renovate, convert, or replace a school, these formulas can be arbitrary and subjective. They do not take into consideration nonmonetary costs or benefits; nor do they address the issues of value to the community, which cannot easily be expressed in economic terms. Moreover, funding formulas compare only the initial cost of construction and do not consider the long-term maintenance and operation of the renovated or new facility. By their very nature, funding formulas imply that older schools, once renovated, are inherently inferior to new

Marietta High School before renovation
(courtesy of Southern A&E)

Marietta High School after renovation
(courtesy of Southern A&E)

In 2001, the Marietta, GA, City School District decided to covert **Marietta High School** into a middle school (Marietta Middle School), but only after much consideration and debate. The oldest building in the main facility was constructed in 1943. Five additions were constructed in 1951, 1955, 1956, 1972, and 1982. After appraising the physical condition of the facility and comparing cost estimates for demolishing portions of the oldest building additions (1943, 1951 and 1955) and constructing new additions, the school board decided in favor of renovation over new construction. This decision was made not only to maintain the community's strong connection to the existing facility but also to reduce the estimated construction costs.

The school board initially hesitated to renovate the school, because the main facility needed a new fire protection system and a complete upgrade of its building infrastructure, including mechanical and electrical systems. The facility finishes, doors, hardware, and windows needed replacement, and about a half million dollars of asbestos abatement work had to be completed prior to construction. Despite these concerns and a very tight construction schedule (14 months), the successful project was completed on time and approximately $415,000 under budget at a total cost of $9,955,029.

Renovation required reconfiguration of spaces to accommodate the new middle school's educational program. Many spaces were gutted to accommodate new handicapped ADA-compliant restrooms, new teacher planning rooms, janitorial closets, storage rooms, and office and administrative spaces. Overall, renovation yielded an additional ten classrooms. The renovated facility was also designed to accommodate future student growth, eliminating the need for portable classrooms. Project Architects: **Southern A&E; M.B. Kahn Construction.**

construction. This simply is not true and, once again, depends upon the quality of construction and can only be assessed on a case-by-case basis. Such blanket statements or generalizations ignore the reality that many older schools have lasted the test of time and simply cannot be replicated in craftsmanship or quality of materials.

School Site

Most of our nation's older and historic schools were originally designed as neighborhood schools. Built to accommodate fewer students, they drew from a smaller geographic area and anchored the neighborhoods they served. They were also built at a time when students walked to school. During the last decades of the twentieth century, school districts moved away from the concept of neighborhood schools. Today, communities increasingly recognize the advantages of students attending school in their immediate residential area. These advantages include decreased vehicular traffic, increased after school participation in student extra-curricular activities, and greater parental involvement.

Today, more than half the states provide guidelines that mandate or recommend the minimum number of acres needed for a school site. In general, these guidelines apply to new construction and to schools undergoing rehabilitation, though in some states the latter are exempted from the mandated acreage requirements. Other states have no acreage requirements and leave school site size to the school district's discretion. Site acreage requirements vary considerably from state to state. At one end of the spectrum are states that mandate no minimum acreage requirements but advocate the selection of school sites based solely on their ability to accommodate the proposed educational and community programs; at the other end are states that withhold approval or financial aid for projects that fail to comply with minimum acreage requirements.

In general, the number of acres mandated or recommended for school sites varies by grade configuration. Minimum acreage requirements are often expressed in terms of square footage per pupil or number of acres per student. Often the requirements apply to the entire educational facility, although a few states address the issue of recreational areas and parking separately. Several states have no minimum acreage requirements for school sites but instead dictate the size and number of the various functional areas within a school, thus indirectly influencing the school size.

Minimum acreage requirements can be a challenging barrier to the rehabilitation of older and historic schools in both rural and urban communities. These policies encourage the consolidation of small schools and the construction of large schools. They also tend to move schools away from existing population centers, which contributes to suburban sprawl (Lawrence 2003b). Minimum acreage policies have had a devastating impact on rural schools and urban schools, particularly in areas where neighborhoods have grown up around a school, leaving no land for site expansion. This lack of space has also made it difficult for schools to offer a full range of athletic programs and at the same time address Title IX requirements for equal treatment and opportunities for athletics for boys and girls. When coupled with decreasing school enrollment and the small size of many older and historic schools, school districts often believe that they have no choice but to abandon older schools and locate new schools in large, open spaces often available only on the urban fringe.

Overcoming Site-Related Barriers to Rehabilitation

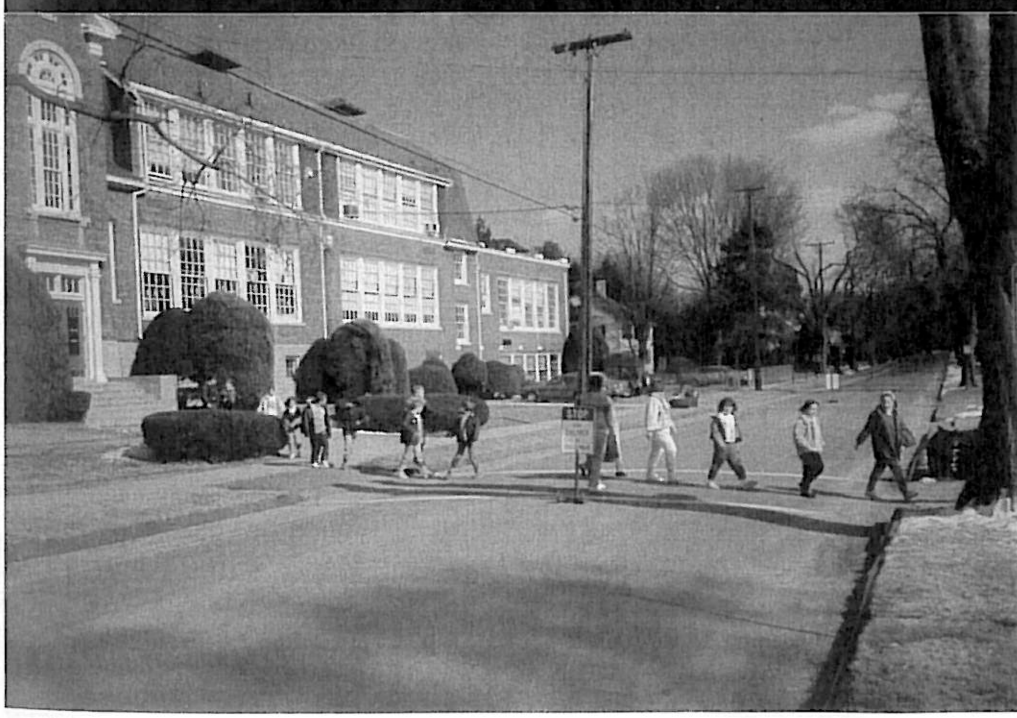
States are increasingly abandoning or modifying acreage requirements. Maryland, for example, has dropped acreage requirements altogether, while providing incentives for the development of existing school sites or their adaptive reuse. School facilities are assessed not against generic standards but with respect to their ability to meet the school district's educational program. This has allowed districts to retain their older and historic schools as charter or magnet schools, testing centers, and teacher resource centers, which house smaller student populations and do not require large school sites. Massachusetts and Vermont also have no minimum acreage requirements for schools. State guidelines recommend school sites accommodate the educational program while minimizing possible adverse impacts upon the community. Rhode Island, while possessing minimum acreage requirements, emphasizes that school sites should be chosen to serve the proposed educational program and should be located, whenever possible, near other community facilities and resources that would enhance the educational program. In Oklahoma, acreage require-ments may be modified if the school site is adjacent to park and recreation lands. Georgia concedes lower acreage requirements when land is at a premium. In New York, the minimum acreage requirement for school sites applies only to new

Situated on the historic town Green, Center School is the oldest K-4 elementary school in Longmeadow, Massachusetts. The school complex consists of two separate buildings on a six-acre lot separated by a public road. Prior to renovation the lay-out required children to cross the road in all weather conditions to eat lunch in the main school building cafeteria and attend gym class in the annex. The playground was a tiny wood chip area surrounded by a parking lot. The two facilities, which were constructed in the 1920's, had tremendous heating, roofing, and acoustic problems. To further complicate matters they did not comply with current building and access codes. Expanding enrollment and the town's long-term plan to move grade five and pre-kindergarten to the current K-4 education program called for more classrooms and specialized areas.

The town's Historic District Commission required that any addition not be visible from the historic green, nor could the front façade of the existing facilities be altered. To qualify the project for state reimbursement, the two buildings had to be connected; both buildings had to conform to the Massachusetts State Building Code; the school had to provide special needs areas; and the renovated facility had to operate for the next fifty years.

The architect's design solution rerouted the existing residential road around the two schools and manipulated the existing topography to provide a below-grade addition uniting the two buildings. The 100,500 square foot additions, consisting of a new library and media center, an adjacent computer laboratory, and a connecting corridor, cannot be seen from the town green. Creative landscaping masks the large masonry plaza on top of the addition that is used for large group gatherings and safe, outside crossing between the buildings. Aside from the new slate roof on one building and the repaired roof on the other structure, the facilities look the same as they did when they opened seven decades ago. From the rear of the two buildings, the curved glass façade of the library joins the two landmarks.

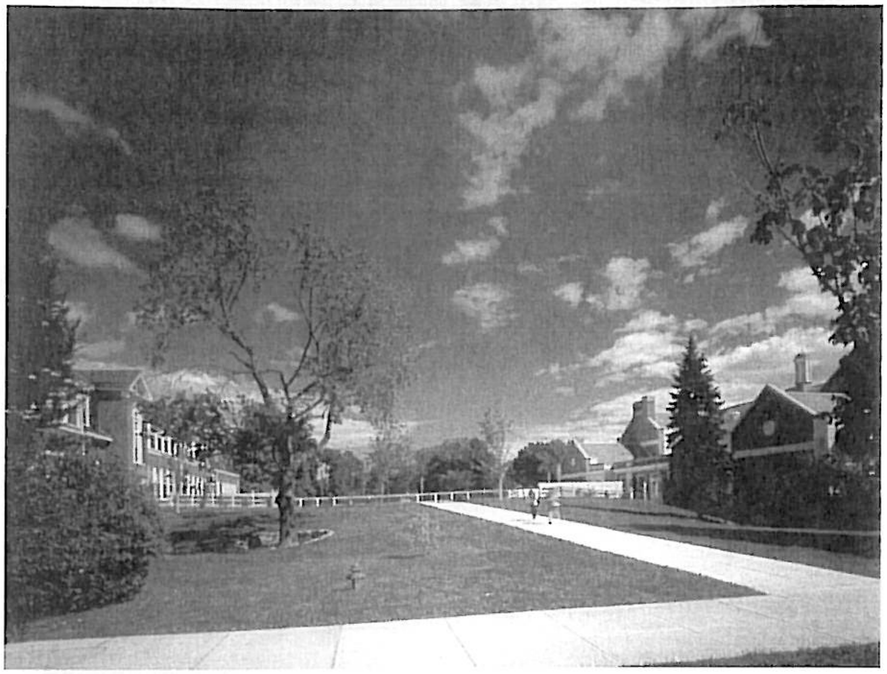
After builders gutted the main school building and half the annex, new steel frames were constructed and the interiors were rebuilt in a playful, spacious manner to incorporate natural sunlight. The original small, angular classrooms and dingy green hallways were replaced by a maze of glass and light. The original arched-ceiling "kindle room" in the upper level of the annex building, however, was preserved and is still visible. The expanded school program also included construction of new second-level classrooms in the main school building, kindergarten classrooms (pre-kindergarten/kindergarten), art and music rooms, and special needs areas as well as a relocated cafeteria and kitchen. All building systems were upgraded to meet code, and the state-of-the-art climate control system continuously pumps fresh air through buildings where temperatures once fluctuated twenty degrees between rooms. More than seven miles of computer lines have been installed with computers in every classroom. In addition, the outdoor playground area outside more than doubled in size providing maximum use the available outdoor play space. Project Architect: **Tappe Associates.**



Children at Longmeadow Center Elementary School crossing the street to access the cafeteria and gym prior to renovation
(courtesy of Tappe Associates)

construction outside of urban areas.

Without arbitrary site standards, schools districts apply creative strategies to deal with limited sites in established neighborhoods. Often selective demolition of poorly planned additions can make way for more compact, functional, and appropriate expansion of the core facility. With proper planning and consultation with neighbors and parents, modest site expansion can be accomplished through acquisition of adjacent property. There are numerous examples where rehabilitation has successfully accommodated increased student enrollment and expanded programs without



View of Longmeadow Center Elementary School campus after rerouting of an existing road (courtesy of Steve Rosenthal Photography)

damaging the historic integrity of the school or significantly expanding the size of the school site. Frequently, multi-story additions are constructed to meet educational requirements and to conserve limited acreage.

Many schools have also addressed site deficiencies by forming partnerships with local municipal governments to take advantage of community resources. In these cases, the community is viewed as an extension of the school site. This strategy has minimized on-site space requirements for libraries, performing arts facilities, parking, and outdoor recreational spaces. The use of multipurpose or centralized sports facilities has also allowed schools to share the same facility and reduce demand at remote sites. Many urban schools have also developed strategies to take advantage of street parking, public parking facilities, and public transportation to minimize the need for on-site parking. Sometimes arrangements can be made with nonpublic entities, such as churches or synagogues, for the shared use of adjacent parking areas during the week for the public school and on weekends by the religious entity.

Building Codes

"Coming up to code" is often viewed as an obstacle in the rehabilitation of older and historic buildings, with schools as no exception. People assume it is impossible or prohibitively expensive to bring older buildings into compliance with modern codes. While it is true that in the past building codes have posed a significant barrier to the rehabilitation of older and historic buildings, the national model building codes have led the way in recent years in developing a regulatory climate more supportive of rehabilitation.

Building codes regulate new construction and work on existing buildings. They dictate standards for construction, including permissible types of construction; quality of building materials; minimum floor and roof loads; permissible electrical and mechanical equipment; and health and safety requirements. Building codes also address change of use or occupancy in existing buildings, because such a change may introduce new or greater hazards. The model codes classify buildings as well as specific areas within a building according to use and occupancy. Different technical and administrative requirements may apply depending upon a building's classification. Schools are classified as educational facilities, but the auditorium and cafeteria as well as other areas may fall into a different classification.

Local municipal governments may adopt a building code or have one prescribed for them by the state. Historically, states and municipalities adopted one of the following three model codes:

- ☑ *National Building Code*, published by the Building Officials and Code Administrators, International (BOCA)
- ☑ *Uniform Building Code*, published by the International Conference of Building Officials (ICBO)
- ☑ *Standard Building Code*, published by the Southern Building Code Congress International (SBCCI)

In 1994, the three model code organizations established the International Code Council to develop a single, comprehensive set of national model construction codes (International Code Council 2003a). With the publication of the 2000 *and* 2003 *International Building Code* (ICC 2000, 2003*b*), 2003 *International Existing Building Code* (ICC 2003*c*), and other related specialty codes, the national model codes have ceased to revise and update their own codes. To date, twenty-three states have adopted the International Building Code, and several others are considering it. A competing building code is published by the National Fire Protection Association, NFPA 5000 *Building Construction and Safety Code* (NFPA 2003).

The International Building Code requires all additions, alternations, and repairs to existing buildings and structures conform to the provisions for new construction. Where this is not possible, specific compliance alternatives must be met to mitigate life and fire safety issues. The IBC permits the use or occupancy of the existing building to change without conforming to all the requirements for new construction associated with the new classification, provided the new or proposed use is less hazardous than the existing use, based on life and fire risk. In both instances, the local building official makes the final determination. Historic buildings are treated as a special subset of existing buildings. The provisions of the building code are not mandatory for historic buildings if the local building official judges the proposed alteration, addition, or restoration not to constitute a threat to life safety. If deemed a threat, the structure must comply with the provisions of the existing building code.

State and local governments may adopt any building code, (unless, in the case of counties and municipalities, one is prescribed by the state), and may amend the code to address or mitigate specific areas of concern. In many jurisdictions, public schools are not subject to local code enforcement, but rather to regulations of the state department of education or board of education. These regulations are often based on one of the national model codes and may be more stringent than the requirements of the locally adopted code. Historically, local amendments to the national model building codes have been the greatest barrier to rehabilitation and the most difficult to overcome.

Some local administrative code provisions have subjected existing buildings to the requirements for new construction when certain alterations or reuse triggers are applied. Lawmakers require full building code compliance when there is a change to ensure safety under conditions of the new use. Similarly, the rationale behind requiring full building code compliance for major alterations is to take advantage of the construction to upgrade features for life safety. Full compliance with a modern building code, however, can significantly increase project costs for any older structure, and it may thwart efforts to reuse a building.

To address this issue, the IBC provides a set of compliance alternatives for existing buildings. This section of the code recognizes that older buildings, particularly those with desirable historic features, present a challenge to conventional code compliance. The IBC is designed to evaluate those items that can be observed without access to the design documents for the building and without destructive inspection. A numerical evaluation process quantitatively examines eighteen important parameters, focused on areas of fire safety, means of egress, and general safety to assess the existing level of building safety. If one or more of the parameters receives a failing score, the owner and design professional can decide which of the eighteen building features can be improved to achieve a passing score. These compliance alternatives allow existing buildings to overcome technical deficiencies by improving elements that contribute to occupant safety in a way that is economically feasible and preserves the building's character. The IBC does require the building to have the specified number of exits under the conventional building code provisions. The building also must comply with the Americans with Disabilities Act. This alternative compliance method is acceptable for the evaluation of all buildings except high-hazard occupancies and is therefore applicable to schools.

Life safety need not, and must not, be compromised for historic integrity or economy. Safety and the rehabilitation of buildings are complementary, not contradictory, goals. That said, the special nature of materials and building techniques found in older and historic buildings must be taken into account as planners work to resolve differences between code compliance with the special character of older buildings. Because schools were one of the first building types to which building codes were applied, and because the safety of our children has long been a priority in our society, older and historic schools were usually designed with basic life safety provisions. The flexibility afforded by well administered modern codes allows planners to rehabilitate many older and historic schools and stay in compliance with building codes. Discussions between the owners, design professionals, and the code official should begin at the earliest possible opportunity to address the building's significance and the project's safety goals. With these parameters established, the best method to satisfy those goals and comply with local regulatory requirements can be established.

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) is intended to make American society more accessible to the disabled (Department of Justice 1994). Public entities such as schools must be accessible to and usable by individuals with disabilities. Access may not segregate disabled students from the rest of the student population, unless separate programs are necessary to ensure equal benefits or services. The International Building Code contains accessibility provisions intended to ensure compliance with the Americans with Disabilities Act. Unless technically infeasible, accessibility provisions for new construction apply to existing buildings, including those identified as historic, undergoing alteration. In addition, where an alteration affects an area of primary function, the route to that area must be accessible and include appropriate access to toilet facilities and drinking fountains. Where it is technically infeasible to comply with the accessibility provisions for new construction for any alteration, the IBC provides various compliance alternatives.

Alterations to a historic building must comply with the accessibility provisions unless compliance with the requirements for accessible routes, ramps, entrances, or toilet facilities would significantly compromise the historic significance of the building. In such a case, the following alternative minimum standards must be met:

1 At least one accessible route from a site access point to an accessible entrance shall be provided.

2 An accessible route from an accessible entrance to public spaces on the level of the accessible entrance shall be provided.

3 At least one main entrance shall accessible.

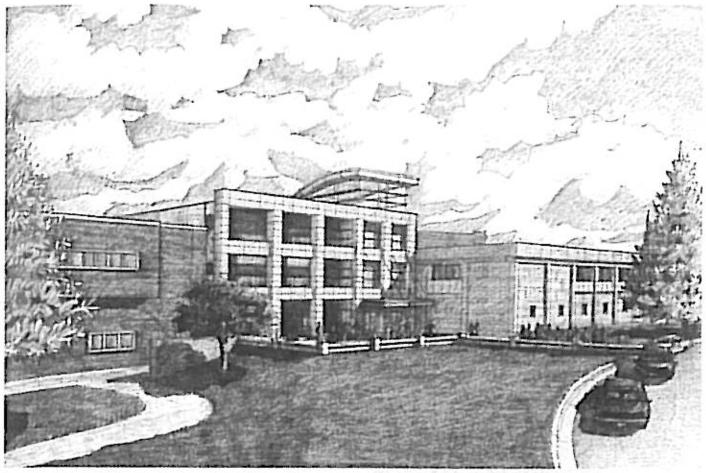
4 Where toilet rooms are provided, at least one accessible toilet room complying with the provisions for new construction shall be provided.

5 The slope of a ramp run of 24 inches (610mm) maximum shall not be steeper than one Unit vertical in eight units horizontal (12% slope).

Barriers to ADA Compliance

When rehabilitating older and historic schools, even technically feasible ADA compliance may present a challenge because of the need to introduce new architectural elements. The introduction of ramps and elevators, as well as the expansion or addition of handicapped restrooms requires additional space that may be obtained only at the expense of classroom space. Installing ramps to make entrances, door thresholds and other building elements accessible, while maintaining appropriate slope and width without obstructing foot traffic, may prove difficult. For historic schools, the introduction of interior and exterior ramps takes special care and creativity to avoid detracting from the building's unique architecture features. Retrofitting buildings with elevators is equally difficult, given that it may be necessary to make major structural alterations.

Creative architectural designs and engineering can minimize the cost of ADA compliance. This might begin with the removal of nonhistoric additions that have often complicated access over the years. When a new addition is planned, providing accessible entryways into the addition and then using ramps and lifts to create accessible routes throughout the existing building usually achieves ADA compliance at reasonable expense. ADA access to different floors in multi-level schools can be accessed through an elevator located in the new addition or, at slightly more cost, inserted within the existing structure. This approach preserves the building's historic fabric while minimizing the costs associated with ADA compliance.



Artist's rendering of renovation of East High School
(courtesy of Beringer Ciaccio Dennell Mabrey)

East High School in Des Moines, Iowa, was originally built in 1910 and includes several additions constructed in the 1970s. Before renovation, it had as many as thirteen elevation changes that required accessibility. Preliminary studies projected five to seven elevators to tie all the floor levels together, but this was not feasible given the extremely tight budget. Through careful planning and orientation of the proposed new addition, the architects rendered all levels accessible using only three elevators and three ramps. Architect: Beringer Ciaccio Denell Mabrey (BCDM); formerly **ZBM Partners Architects**.

ADA *access through main entrance at Jason Lee Middle School*
(courtesy of Krei Architecture)

Built in 1923, **Jason Lee Middle School** in Tacoma, Washington, underwent extensive renovation in 2000. Access to the historic school consisted of exterior steps four and a half feet above grade. To accommodate ADA requirements, Krei Architecture designed a ramp system adjacent to the existing steps in keeping with the historic brick school facade. The ramps gently curve up to the entries, appearing as if they may have been there all along. Among many other ADA-compliant facilities is an elevator serving both floors and accessible toilet rooms. A historic theatre was also renovated to accommodate ADA accessibility requirements. Architect: **Krei Architecture** (formerly **Merritt Pardini Architects**).

Building Systems

Electrical Systems

Electrical codes are not retroactive, but electrical work performed for the reuse of the building must conform to the edition of the National Electrical Code adopted by the local jurisdiction. Typically, all electrical systems are replaced when an older or historic school is renovated to ensure compliance with local building and electrical codes and to accommodate the greater power requirements of new technologies and building systems. Though renovation may involve extensive replacement and rerouting of electrical lines, the process is relatively straightforward and typically costs no more than the installation of an electrical system in a new building. In general, electrical power upgrades begin at the service entrance, where the power enters the building, and include power, cable and communication lines. Service entrance switchgear is the most important part of a school's power distribution system and must be sized to meet the present and future needs of the school. This equipment also must be properly situated within the school to facilitate distribution of electrical power. Distribution throughout the school can be in walls, above ceilings, or in bus ducts and cable trays that can be exposed if necessary. Attractive plug mold systems are also available that can be surface mounted on classrooms walls or designed as baseboard elements if wall access is limited.

Until the 1950s, most schools relied on natural light from windows and lightwells to illuminate classrooms and other school areas. With the advent of cheap electricity, electric lighting was introduced—first as incandescent and later as fluorescent lights—that provided greater flexibility and convenience. Incandescent light fixtures in most older schools have been replaced to comply with current illumination standards to achieve greater energy efficiency. Unfortunately, early fluorescent light fixtures contained PCBs in their ballasts, which pose a serious health risk if inhaled or consumed. Although this material was banned in 1979, lights in place or stockpiled at that time could still be in use in some older schools today. With age, these light fixtures are prone to leaking. Since this presents a substantial risk of contamination, they must be removed as part of any complete lighting retrofit. Period lighting in older and historic schools, which retains unique or historic architectural elements, however, should be maintained wherever possible. These fixtures can often be retrofitted with newer, more efficient technologies, such as compact fluorescent lamps that last much longer and cost less to operate.

Cassingham Complex, Bexley City Schools, classroom
(courtesy of Miles McClellan Construction & Development)

Cassingham Complex, Bexley City Schools, theater
(courtesy of Miles McClellan Construction & Development)

Renovation of **Bexley City School's K-12 Cassingham Complex** in Bexley, Ohio, presented many challenges. The complex consisted of a hodge-podge of buildings constructed over a sixty-year period. Work included the renovation of the existing 280,000-square-foot complex and the construction of 70,000-square-feet of new additions. Upgrading the mechanical, electrical, and plumbing systems proved particularly challenging. The buildings possessed a mix of current and outdated electrical components (switch plates, outlet covers, fuse boxes, breaker panels, and wiring), plus old wiring that was no longer active but abandoned in place. The undersized electrical systems could be easily overloaded as the power requirements of the school increased following renovation. Without a ready supply of replacement parts, even systems that were still functional and sized correctly were not serviceable.

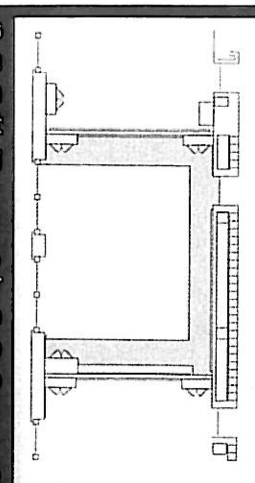
To allow the school to remain open, all major infrastructure work was done at night and during summer vacation and holidays. Before renovation, survey teams walked every inch of the complex and reviewed all electrical systems in each building to determine which elements required replacing. Though not all wiring required replacing, new distribution equipment was added throughout the facility, as well as new lighting and HVAC systems. Because of its size, the existing boiler room was used to house the new air-handling units. Architect: **Miles-McClellan Construction & Development.**

Heating, Ventilation, and Air Conditioning Systems

Heating, ventilation, and air-conditioning systems (HVAC) may be one of the most intrusive systems installed in older and historic schools. Most older schools originally used steam boilers for heating and natural ventilation for cooling, but over the years have undergone various retrofits to accommodate newer, more efficient HVAC systems. Insensitive introduction of these HVAC systems in older schools invariably has a negative effect on the physical appearance and historical integrity of the building. This was particularly true for multi-storied schools, where adding forced-air mechanical systems required construction of new vertical chases to move tempered air through ductwork. When ductwork was too large to be installed above the finished ceilings in classrooms and hallways, it was left exposed or hidden behind false ceilings. Hiding ductwork and piping above suspended ceilings not only reduced the overall ceiling height of the classroom and the amount of daylight entering the room, but also obscured any decorative ceiling finishes and ornamental detail. Classroom windows were often sealed shut to maximize energy efficiency. The use of through-the-wall and window air-conditioners results in significant damage and detracts from a building's overall physical appearance.

The most appropriate HVAC system for any given project typically depends upon the intended configuration and modifications to existing spaces. New high-pressure variable air volume (VAV) systems allow smaller ductwork that can often be inserted in existing shafts and above ceilings or within modern soffits installed around the room. New hydronic heat pumps and fan coil units allow for the distribution of small piping that can be easily threaded through existing interstitial space and converted to forced air delivery. Sometimes original areas or structural components of the building, such as old fireplace flues, ventilation shafts, and dumbwaiters, can be reused as vertical chases for new mechanical ductwork or piping though a variance may be required if local code requirements limit their adaptation. In general, the space requirements for modern heating and cooling equipment are much smaller than the original systems and can easily be accommodated in the original boiler room or other mechanical spaces. These rooms, however, may not be ideally situated in the building to accommodate new equipment or they may not meet today's code requirements for fire separation from other areas of the school. Not all systems need to be completely hidden from view; exposed ductwork and other mechanical systems and pathways can be integrated into the curriculum and used as a teaching tool. Relocating the mechanical room in an area of new construction is also a possibility.

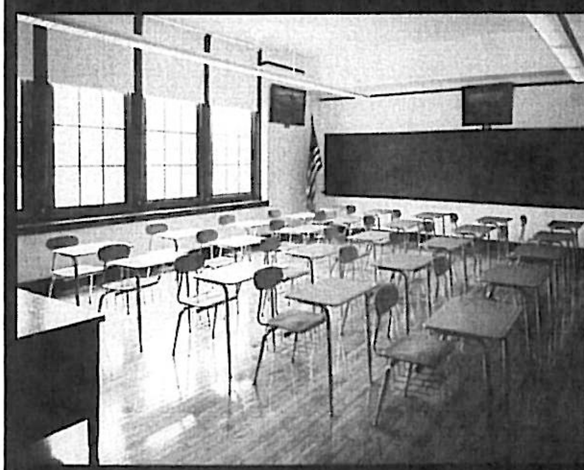
Built in 1915, **Edward Lee McClain High School** stands apart from other public schools with its bold Georgian design, Tiffany amber lamps, classical statuary, rooftop gardens, and more than 165 works of art. Yet, after eighty-five years, the school was in dire need of repair. Rather than abandon the school, the local school board undertook a comprehensive restoration that made it one of the most state-of-the-art schools in the nation and changed state funding policies, making McClain a national model for school preservation.



Schematic diagram of soffits in classroom at McClain High School (courtesy of TRIAD Architects)

Because the estimated cost of renovation was less than two-thirds the cost of replacement, community leaders feared that they would have to forfeit state funding to keep their school. After **TRIAD Architects** built a case in favor of preserving exemplary educational facilities, the Ohio School Facilities Commission considered the building's historical significance and agreed to change its regulations to allow for waivers to the two-thirds rule. McClain was the first school to qualify for state funding under the new policy.

Restoring the building's historic architectural and decorative elements was important to the community, as was updating the technology, mechanical, electrical, and plumbing systems. Early renovations in the early 1970s incorporated a window ventilation system that used a central boiler, characteristic of poorly executed historic school renovations. This prior renovation disrupted the original design intent by exposing ductwork inside and outside the high school and pipes on the interior, adding louvers to windows, and punching holes for ventilation units through the front façade. Not only was the ductwork and piping unsightly, but it was too noisy for the educational environment.



McClain High School classroom after renovation with soffits on three walls (courtesy of TRIAD Architects)

To restore the building to its original appearance, the design team replaced the HVAC system with a variable air volume (VAV) system with centralized boilers and cooling towers hidden from view. All exterior louvers were removed, and the windows and penetrations were restored to their original condition. The VAV system was custom-designed for temperature and humidity control to protect the paintings, frescoes, statues, tiles, and murals that line the halls and classrooms. Some systems were disassembled and reassembled inside the building to avoid damaging the historic structure.

A system of soffits, located along three walls of each classroom, accommodated ductwork and piping for the VAV system so that the ceiling-high windows on the fourth wall could remain. The badly deteriorated windows were replaced with maintenance-free windows and restored to their original height, complete with molding, trim, and divided lights selected to match the originals. The nonintrusive soffit additions preserve the original hard plaster ceilings, original wood floors, and cabinets. As a bonus, the soffits, made of gypsum board and detailed with matching woodwork trim, provide direct light to the slate chalkboards, which also were restored. The design team re-toothed the slate chalkboards and placed them in their original oak frames. Existing chaseways, ventilation shafts, and the old central vacuum cleaning system were also used to house ductwork, wiring, data systems, and plumbing components. To heat the grand library, a heating system was designed into window seats in a fashion similar to early twentieth-century warming benches found in other locations within the building. Project Architects: **TRIAD Architects**.]

Plumbing Systems

A single older school probably will contain a wide range of plumbing systems. This is particularly true for schools that have undergone several renovations over the years and have been adapted or retrofitted to meet different plumbing codes. Different sizes of plumbing as well as plumbing manufactured from different materials may be present. Old lead piping used in the past has mostly been replaced with less hazardous materials. However, lead plumbing may still be present in areas that have not undergone alteration or repair, or in schools that have been abandoned.

The plumbing found in older schools is often corroded and a common source of water damage. Even when functional, the plumbing may be undersized and unable to accommodate increases in student enrollment. Although plumbing codes are not retroactive, new plumbing work required for reuse of the building must conform to the current plumbing code, and the new construction may trigger ADA requirements in matters such as height and size of toilet fixtures and size of restroom facilities. In some jurisdictions plumbing codes require that the lavatory rooms be reconfigured and that additional fixtures be installed, which requires expansion of the old plumbing system. For these reasons, builders commonly replace all water and sewer piping throughout the building, starting at the utility mains. This ensures the use of code-compliant materials, installation methods, and sizing requirements. While underground systems can be abandoned in place, above-ceiling plumbing is typically removed to accommodate new systems and to avoid confusion over which lines are still functioning.

Communications Technology: Voice, Video, Data, and Security

Many older schools have developed an effective infrastructure to meet their technological needs. The term "infrastructure" refers to everything that supports the flow and processing of information. It includes the hardware and software used to connect computers and to send, receive, and transmit signals; transmission media such as telephone, television and cable lines, and satellites, and other devices that control the transmission paths, such as routers and repeaters; and sometimes alarm and security technologies. The ease with which older schools can support this infrastructure depends upon the technologies needed to support the educational program and the degree to which emerging technologies, such as wireless networks, will be used. It also depends upon the level of on-site and off-site access students, teachers, and administrators need to the network, the Internet, and video resources.

The school's architectural design and the extent of rehabilitation proposed may be mitigating factors. Integrating new technologies into an older school is much easier if the structure is undergoing complete rehabilitation requiring replacement of all power systems, and if access to wall interiors and ceilings is readily available to run hard-wired systems. Partial rehabilitation may present more problems, especially if the technology infrastructure must be integrated into the building with minimal damage to existing architectural features. While wireless systems (which do require some wiring) may resolve many of the difficulties of integrating technology into older schools, hard-wired systems still represent the most economical choice for most schools. Generally speaking, older schools have plenty of interstitial space in which to route the small cables in use today. Wires can be run in bus ducts, in walls, and over ceilings. Where access is limited, they may be installed in unobtrusive wire-mold systems run along the walls.

An information technology infrastructure requires a central space separate from other building systems and equipment areas, where the growing array of equipment can be housed. For large campuses, additional spaces may be needed to accommodate several distribution centers. In older schools, existing spaces may have to be renovated to create these spaces. As in any facility, old or new, the introduction of new equipment and technology systems requires adjusting the overall power service requirements based on new load calculations. The HVAC loads, too, must be adjusted to accommodate computer systems that generate a significant amount of heat.

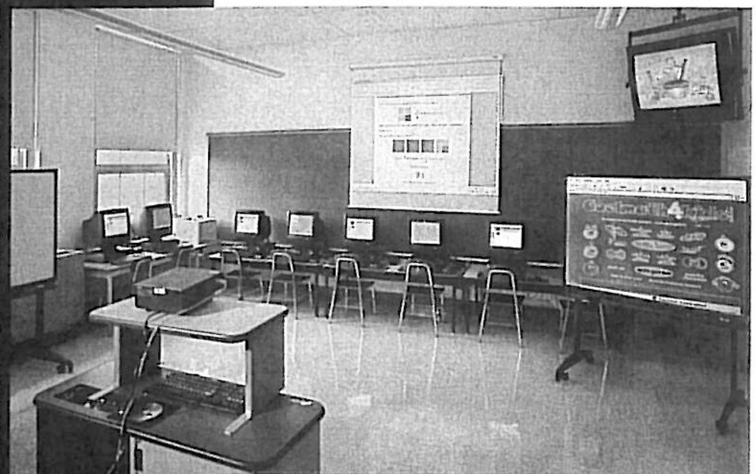
Structural Systems

Structural systems include the foundation, load-bearing walls, columns and beams, roof, and floor slabs. A detailed structural analysis of an existing building should be performed to determine the adequacy of its structural systems, to identify any problems or potential failures, and to study the effect of any proposed addition or alteration. Structural analysis may reveal corroded, decayed, missing, or inadequate structural elements, as well as the need for additional structural elements to ensure compliance with building and seismic codes. Architects and structural engineers are trained to identify problem areas by observation and will recommend more extensive analysis if necessary.

Any discussion or generalization about the structural integrity of older schools is complicated by the variety of materials and techniques used in the construction of the original building, and any subsequent renovations. In general, however, schools constructed between 1900 and 1950 were well built and are structurally quite sound. Today, the high cost of their demolition reflects their structural integrity. Unreinforced masonry structures built during that period relied on their sheer mass to provide structural stability and resistance to lateral forces. In the absence of precise data regarding the performance of materials under load, these structures were often overbuilt for static loads; however, they may require reinforcement in seismic zones. An addition that is structurally connected to the existing building may require that the entire structure conform to the seismic resistance requirements for new construction. Nonetheless, with careful planning and coordination with local building code officials, many older and historic schools have successfully undergone seismic retrofitting at reasonable cost.

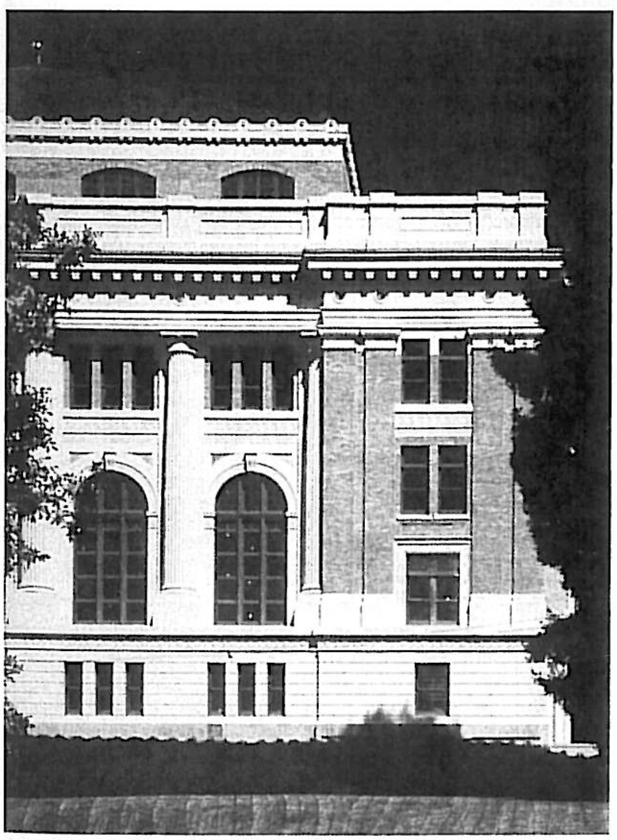
Weil Technology Institute, a 78,000-square-foot K-5 elementary school, is the first school in the Pittsburgh public school system to fully integrate technology in all aspects of its curriculum and teaching functions. This 1920s Art Deco structure (originally known as Weil Elementary School) was recently renovated to serve disadvantaged students in the district who were interested in pursuing a vocation in one of three core academic areas: robotics, entrepreneurship, and the performing arts. Designated a local historic landmark by the City of Pittsburgh, Weil required a sensitive approach to the treatment of interior and exterior building elements and an upgrade of infrastructure to accommodate new information technologies.

A complete video retrieval system was installed, capable of providing programmed video lessons to any room or group of rooms. As part of the district's overall technology plan, the school was completely rewired to provide fiber-optic land-line connection to the Internet and to the district's network. Each classroom has a full complement of technology aids. Smart TVs are used for distance learning, video retrieval, and cable and satellite program monitoring. Smart Boards support interactive digital presentations, learning, and group discussions. Mobile hot-wired teacher lecterns connect fully with all the classroom equipment and computers. The school is wired to the school district's central data center, allowing inter-school communication. The Piano Lab and Choral Room Suite have a professional sound recording studio comparable in quality to some of the best recording facilities at local universities. Project Architects: **Strada Architecture**



Classroom Weil Technology Institute
(courtesy of Jim Schafer Location Photography)

Renovation and expansion may entail significant work on existing structural elements. For example, the reconfiguration of classroom spaces and administrative offices may require removing and relocating load-bearing walls. If additional stories are planned, geophysical load tests may be needed to determine whether the existing foundations can accommodate additional loads. Such renovations can be costly and technically challenging, particularly in the absence of architectural plans and building records with detailed documentation of the structure's design loads.



West façade of Franklin High School
(courtesy of Bassetti Architects)

Fire Detection and Suppression Systems

Building codes typically require installation of fire-detection and suppression systems in new and renovated schools. These systems are often installed above a suspended ceiling to hide piping and other utilities. Though a convenient and cost-effective solution, the introduction of drop ceilings often conceals original, decorative ceiling elements. In some wood structures, there may be a requirement to install a sprinkler system both above and

Franklin High School, a 1911 Beaux-Arts building constructed in Seattle, Washington, was originally regarded as the finest school west of the Mississippi. The school is adorned with rich details, including coffered ceilings, terra cotta details, brass clocks, and beautiful high windows. By the 1980s, the school was suffering major problems, including asbestos contamination, major seismic inadequacies, a leaking roof, and obsolete mechanical and electrical systems. The Seattle Public School District proposed to raze Franklin High School and replace it with a new school, but thanks to the efforts of the Committee to Save Franklin High School, the Seattle Landmarks Preservation Board, students and area residents, the school was preserved and once again thrives as an exceptional historic neighborhood school.

The restoration of Franklin High School involved upgrading critical seismic, life safety, mechanical, and electrical systems in addition to addressing educational program improvements. One key to project success entailed "two-for-one" strategies in which design solutions solved two or more problems simultaneously. For example, a new addition on the east side of the landmark building provided both space for program needs and a seismic buttress for the unreinforced masonry structure.

The restoration of the two-story façade of the Student Commons, which had been covered by a 1950s addition that obscured the beautiful columns and removed the original windows, illustrates the complexity of the seismic upgrade undergone by Franklin High School. Several strategies were adopted to stabilize this area of the structure. The principal strategy was to add two concrete shear walls on the north and south sides of the Commons' west-facing façade. These in-plane shear walls ran from the ground floor to the roof. New horizontal roof slabs above the shear walls helped distribute the loads horizontally to the integrated old and new structures. Two other shear walls also served to stiffen the two-story shell of the Commons. A new shear wall was created by filling the old proscenium opening at the stage with concrete masonry units. New stiff-floor diaphragms were added just below the west side of the Commons and just above the east side. New sill ledgers connected existing floors and walls in spaces surrounding the Commons. These drag struts ultimately were tied into the new addition, which served to buttress the old unreinforced masonry structure. The attic and floor level above the Commons received floor diaphragms and steel cross-bracing. Finally, the large arched windowsills were rebuilt with an interior and exterior knee wall, fully grouted and reinforced, and horizontal sill slab to further stiffen the two-story wall and tie it more effectively to the existing first-floor slab.

The school is now designed to withstand tremblers approaching 8.0 on the Richter Scale. As a result, Franklin High School was unharmed following the Nisqually Earthquake in February 2001. Project architects: **Bassetti Architects.**

Student Commons at Franklin High School
(courtesy of Bassetti Architects)

below the drop ceiling. Today, a number of alternatives are available and have been used successfully. The fire-suppression system may be installed above the original ceiling or, in the absence of a cavity space, a sidewall fire suppression system enclosed in soffits around the perimeter of rooms can be used. If necessary, the fire suppression system can even be exposed. This can be accomplished with careful attention to placement of piping and integration with other systems.

Safety

Most issues involving the safety and welfare of students and staff in schools are addressed by building codes. Building codes typically address design issues such as means of egress (for example, number, location and size of exits, dead-end corridors, fixed projections in traffic areas, panic hardware, door swing, emergency lighting, handrails and guardrails); fire protection (fire-resistance ratings of building materials, fire alarm, detection and extinguishing systems), and building elements (existing vertical openings such as stairwells, smoke barriers, and compartmentalization). Code-compliant renovation of older and historic schools is easiest when relatively little alteration is required and when alternatives for compliance exist. As we have noted, a complete rehabilitation of the interior simplifies reconfigurations needed to address code issues. Typically, the absence of fire-resistant materials in stairwells and other buildings areas can be resolved through the installation of fire suppression systems. Creating alternative exits and exit routes can eliminate existing dead-end corridors. To comply with code requirements for egress, corridor widths can be increased by removing existing lockers. Alternatively, planners can reduce the number of students who must exit from classrooms using the corridor. Even commercially available panic hardware can be installed without the removing original hardware.

The school district may also require additional safety measures to protect students entering and leaving the school. For example, isolating student loading areas from other vehicular traffic and from pedestrian walkways and ensuring that access streets have appropriate signage and other safeguards to allow students to enter and exit the school site safely will enhance day-to-day safety issues. The ease with which older and historic schools can undergo renovation and comply with such provisions depends upon site configuration and adjacent traffic patterns. Ensuring the safety of students when entering or exiting school property will be more difficult for urban schools where space is at a premium. Nonetheless, many older schools have addressed this issue through careful planning and design to accommodate the flow of pedestrian and vehicular traffic.

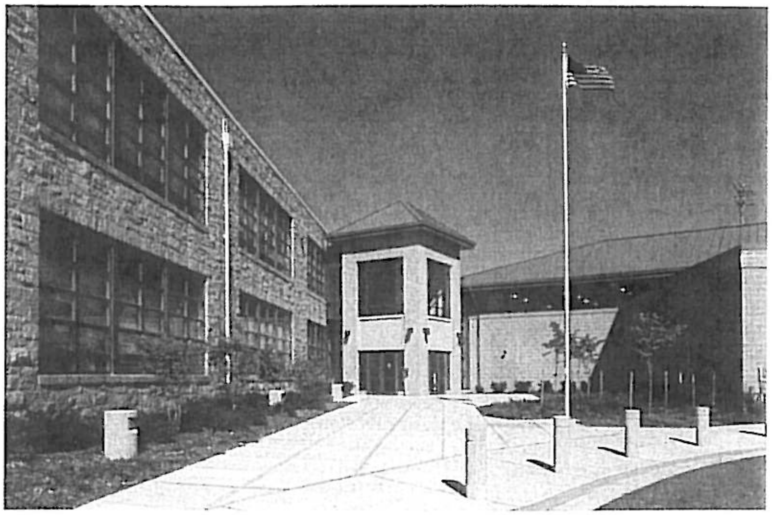
With the rise of student violence and on-campus drug use, districts have sought school designs and operating procedures to help control and monitor students. Areas of the campus that are hidden from view or are difficult to monitor represent a particular concern. Because older schools were not designed with line-of-site issues in mind,

Opened in 1908, **Randallstown Elementary** is Baltimore County's oldest public elementary school. Before rehabilitation, building systems were outdated, and the library and media center, cafeteria, and music and art classroom spaces were insufficient to accommodate the enrollment. This project included the complete renovation of the existing school and the design of a "cafetorium" addition. The renovation included a new sprinkler system, door, window and ceiling replacements, and modifications for handicapped accessibility. HVAC, electrical, and plumbing system were upgraded to meet all modern code requirements. A 9,000-square-foot addition to the east of the existing building houses the cafeteria and kitchen facilities and serves as a multi-purpose dining and assembly area.

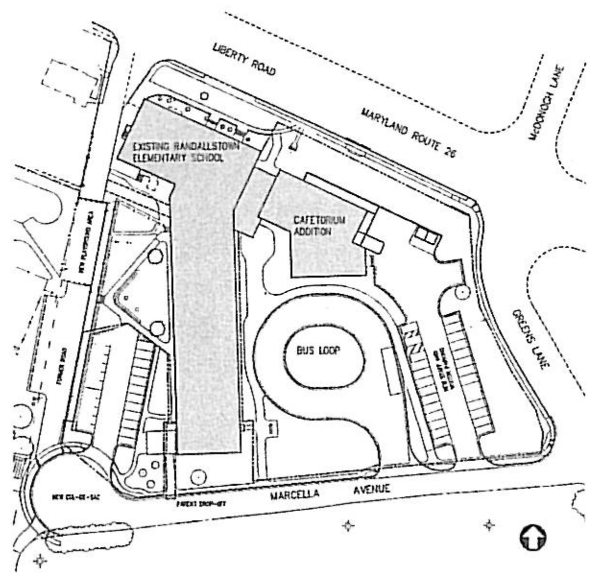
The existing school comprised five levels, none of which were ADA-accessible. The school's main entrance faced the busy main road, and overlapping bus, car, and pedestrian traffic created dangerous traffic patterns. A new addition, linked to the existing school by a new main entrance lobby that includes an elevator, helps to address both these challenges. The new elevator provides access to three main levels of the existing school. Because the elevator is located in the new addition, it does not affect the existing historic fabric. New wheelchair lifts and ramps created accessible routes throughout the rest of the existing building, and new ADA-compliant handrails were installed at all of the existing stairways. Site ramps were also created to provide for accessible access from the school's exterior.

To resolve safety issues, the site redesign separated bus, car, and pedestrian traffic. First, a new bus loop was added in the L-shaped area formed by the existing school and the new addition. A separate area for automobile drop-off was created next to the new addition. From all approaches, new sidewalks were linked to existing municipal walks for pedestrian traffic. The result is that each group of students—whether walking, arriving by bus, or being dropped off—arrives by a different safe path, all of which can be monitored by teachers and administrators from a central location.

All groups are funneled toward the new main entrance to the school, created at the link between the existing school and the new addition. Rather than entering off a busy thoroughfare, visitors now access the main entrance from adjacent parking areas and sidewalks. The new entrance presents a welcoming "face" for the school and its central location, and the new elevator, adjacent to the entry, provides access to the entire school from the main lobby. Project Architects: **GWWO, Inc. Architects.**



New main entrance to Randallstown Elementary School linking new addition (right) to existing structure (courtesy of GWWO Architects)



Main site plan for Randallstown Elementary School (courtesy of GWWO Architects)

accommodating these concerns in a renovation can pose special challenges. However, electronic surveillance systems, which are becoming more common in all schools, can resolve these problems. Hallway lockers, once common features in schools, now pose a security threat for school districts and so have either been removed or placed where they are visible at all times by staff. Restrooms, a perennial headache for school administrators, are also now regarded as a safety concern. Sometimes the solution is the removal of the doors to the corridor so that any unauthorized activity can be heard and monitored. Some districts have placed faculty restrooms so that teachers must pass through the student restrooms to access their own separate spaces.

Sustainability

The concept of sustainability applies not only to the school building itself, but also to the school site and to its relationship to the surrounding neighborhood and community. Schools are called *sustainable* when they display characteristics such as these:

- Energy conservation through high-performance mechanical and electrical systems and renewable energy sources
- Water conservation
- Resource conservation through the use of existing building materials and environmentally friendly construction and maintenance products
- Traffic and parking reduction by taking advantage of existing community resources, such as public transportation, museums, parks, and recreation fields

Environmentally responsible site planning is a key element of sustainability and helps to minimize the facility's impact on local eco-systems. Many older schools, particularly neighborhood schools, are inherently sustainable because they stand in areas of existing development, where they can take advantage of existing infrastructure including public utilities and transportation. Renovation requires no new site development and so does less harm to the environment. In fact, the rehabilitation of older and historic schools may be the ultimate exercise in sustainability, because it avoids the use of additional energy and natural resources to fabricate new materials and put them in place. If we can reduce, reuse, and recycle common household products, we can surely do the same with our schools.

To realize long-term savings through sustainable design, school districts must apply life-cycle cost analysis to all aspects of the school facility. This predicts operating costs over the life of the facility, in addition to initial design and construction costs. To be fair, these should include costs associated with the long-term impact of the sustainable building and site development practices mentioned in the above.

Greenwood Elementary School is an important historical structure located in the heart of Seattle's Greenwood community. The original three-story school was built in 1909. Twelve years later, a three-story classroom wing was added. Bolstered by community support, the school board advocated renovation of the 1909 building, demolition of the 1921 building, and additions to the school to meet new project requirements.

BLRB Architects' aim was to promote parent and community involvement, restore the rich historical heritage of the original structure, and provide a physical environment that supports a variety of teaching techniques and learning styles. The architect was further challenged to incorporate principles of energy efficiency and environmental sustainability, creating a model "green" school for the Seattle School District. The building itself was to serve as a teaching tool, and its sustainable features should further the educational mission of the school.

Plans emphasized five broad areas of design to significantly reduce or eliminate the negative impact of the building on the environment. Site preservation is readily apparent in the adaptive reuse of the old school site as well as conservation of its historic trees.

Extensive use of drought-resistant and native landscaping eliminated a permanent irrigation system, aiding in storm water management as well as safeguarding water supplies. An alternative transportation plan required less on-site parking, and so less impervious surfacing. Low-flow, water-conserving plumbing fixtures with automatic controls reduced building occupants' water use by 33 percent.

Resource management involved not only design through the adaptive re-use of building materials but the construction process as well. A partnership with a nonprofit recycling company led to building materials being salvaged prior to demolition. The building contractor was also required to recycle at least 50 percent of construction waste-much of which was reused as fill.

Energy conservation and environmental quality were significantly enhanced with the renovation of the school. Builders upgraded the building envelope and modernized the mechanical systems to reduce energy consumption. Daylighting was introduced in all occupied spaces and supplemented by quality electric lighting. Operable windows in all classrooms, low emitting construction materials and the new HVAC system help to safeguard indoor air quality.

BLRB's design of Greenwood Elementary is grounded in the belief in architecture's potential to educate and stimulate through physical form. Educational features throughout the facility include instructional alcoves, interpretive signage, an outdoor classroom, student gardens, exposed building structure and systems, and student monitoring of building systems and energy consumption. Project architects: **BLRB Architects.**

Renovated south entry to Greenwood Elementary School using wood salvaged from 1921 building
(courtesy of BLRB Architecture Planning Interiors)

Older schools present opportunities for and challenges to achieving energy efficiency. Many older schools were designed with no insulation in their walls or roofs but relied on the high thermal mass of the building material, such as concrete or brick, to store heat and moderate heat transfer. Energy performance can be optimized by upgrading the building's walls, roofs, floors, and windows, and by replacing existing mechanical and electrical systems with newer, more efficient systems. Because older schools were not designed to accommodate modern air-conditioning systems, great care must be exercised when insulating older schools to improve energy performance.

A number of older schools have been successfully renovated using sustainable building practices. Success, however, has been achieved only when all stakeholders embraced the concept of sustainability and were committed to developing systems and solutions to accomplishing specific objectives.

Environmental Hazards

In addition to building code requirements, schools are often subject to stringent federal, state, and local provisions related to the elimination of environmental hazards. These requirements are often mandatory, regardless of the extent of rehabilitation or work undertaken. Cost estimates of any rehabilitation of older and historic schools must include the cost of mitigating such hazards. In some states, prescriptive standards mandate demolition when environmental abatement costs exceed a specified percentage of the work or value of the property. Lead-based paint and asbestos are two of the most common environmental hazards found in older and historic schools, even though their use as a construction material has been banned for a number of years. Building pathogens associated with mold and bird droppings present another environmental hazard that may bear on a renovation project.

Asbestos

Asbestos is a naturally occurring fibrous material that when mixed with a binding agent can be processed to form a wide variety of materials. Intact and undisturbed, asbestos poses no health risk. However, if the asbestos fibers become friable and are released into the air, they can cause serious health problems. Until the 1970s, almost every school in the United States contained asbestos in floor and ceiling tiles, acoustical plaster, pipe insulation and various fireproofing materials. Over time, as the hazardous nature of asbestos was recognized, a series of federal laws was enacted to address the public's concern. In 1986 the Asbestos Hazard Emergency Response Act (AHERA), federal law required all local education authorities to conduct an initial inspection of their primary and secondary schools for asbestos and to re-inspect their schools at least once every three years (U.S. Environmental Protection Agency 2003). Local education authorities are also required to develop a management plan to remove or mitigate exposure to asbestos by isolating the material through encapsulation or enclosure. Most, if not all, school districts have met these AHERA requirements. If a school district has encapsulated the asbestos, however, federal regulations require removal of the hazardous material before any major renovations.

Lead-Based Paint

Exposure to lead, an extremely toxic substance, can cause permanent learning disabilities in children under the age of six. Until 1978, lead was a common ingredient in most commercial paints. The federal government has enacted legislation to reduce exposure to lead in residential buildings and facilities occupied by younger children (kindergarten classrooms, day-care centers and preschools) built before 1978 (U.S. Environmental Protection Agency 2003). Though the lead-based paint in many schools has been removed or encapsulated, in most older schools lead remains a significant hazard. Only a handful of states have enacted legislation to mitigate lead hazards in primary and secondary schools. In California, for example, school districts must follow strict state guidelines when contemplating any rehabilitation project where lead may be disturbed or where lead abatement is planned (Labor Occupational Health Program, University of California at Berkeley 2003). Legislation requires state certification and training, and mandates safe work practices to protect individuals performing lead abatement work as well as schools district employees and the public during lead abatement projects. Compliance with the work practices outlined in HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* (U.S. Department of Housing and Urban Development 2003) are mandated whenever lead paint abatement is conducted.

HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* recommends a number of methods of paint removal which minimize damage to historic fabric and avoids the removal of historically significant architectural features previously painted with lead-based paint. It also considers methods other than paint removal including the possibility of replacing painted elements with new elements without jeopardizing historic integrity. These methods reflect different levels of treatment that can be used to balance health and safety, economic feasibility, and historic preservation.

Mold

A type of fungus, mold not only damages building material but may also create a significant health hazard. The presence of mold is generally associated with building leaks, improper ventilation and air movement, and poorly functioning air-conditioning systems. Many older and historic buildings were constructed before the introduction of modern air-conditioning systems and relied on fans and open windows to provide air movement. The retrofitting of schools to accommodate modern air-conditioning systems and the introduction of vapor barriers has often led to moisture-related problems. Years of deferred maintenance have served only to exacerbate the problem. Only recently, have states considered legislation to address the health and safety issues associated with mold. The Environmental Protection Agency recently published new guidelines for the remediation of mold in schools and commercial buildings that detail safe and effective work practices to control mold (US Environmental Protection Agency 2001).

Vertebrate Pests

Birds, bats, and rats are a significant problem in many older and historic schools, particularly when the building has been abandoned or maintenance has been deferred for a number of years, and no program exists for their removal or to deter roosting and nesting activity. Birds may carry diseases that can be transmitted through their droppings to humans, particularly when the droppings dry and become airborne. In addition, bird droppings are acidic and will stain and corrode building elements. During the renovation or demolition of schools infested with birds, builders must exercise care to protect the health and safety of all workers and building occupants. In rehabilitating an older or historic school, school districts need to implement strategies to remove and relocate nesting birds and to discourage nesting. A number of physical and chemical methods may be employed to prevent and control bird infestations in structures though the intrusive nature of some treatments may not be an option for historic schools. These steps may add to the cost of rehabilitating an older or historic school.

Conclusion

Renovation of older and historic schools presents both obstacles and opportunities. While most people will not argue the need to preserve a truly historic school, it is far too easy to dismiss an older, run-down school, one whose historic or cultural significance has yet to be documented or acknowledged, in favor of new construction. Too often, such schools are dismissed with little or no consideration of rehabilitation as a viable option. It takes a great deal of skill and imagination to visualize the potential of an older school, and finding the right architect and planner is critical to the success of any renovation project. Renovation is not for every district nor for every architect. Rehabilitation requires thinking outside the boundaries of time, cost, and quality typically imposed on school construction.

Too often, we ask the wrong question. It is not "why should we preserve and renovate that old school?" The very question denies any merit the old building may have and places those in the community with strong ties to the school on the defensive. Rather, we might ask, "Why do we want to tear it down and build new?" The desire to build a state-of-the- art facility to meet new educational programs is both valid and noble, but it does not justify the abandonment of reason or denial of a voice to those in the community who might not agree. It does not justify the use of evolving guidelines and rules governing the decision-making process as an excuse to avoid thinking about and working toward an informed decision that engages all stakeholders. Too often, the professed need to demolish older schools reflects nothing more than the school district's desire to rid itself of an embarrassing eyesore, perhaps one of its own making. Not all older schools merit renovation, but they deserve the respect of a fair and balanced hearing.

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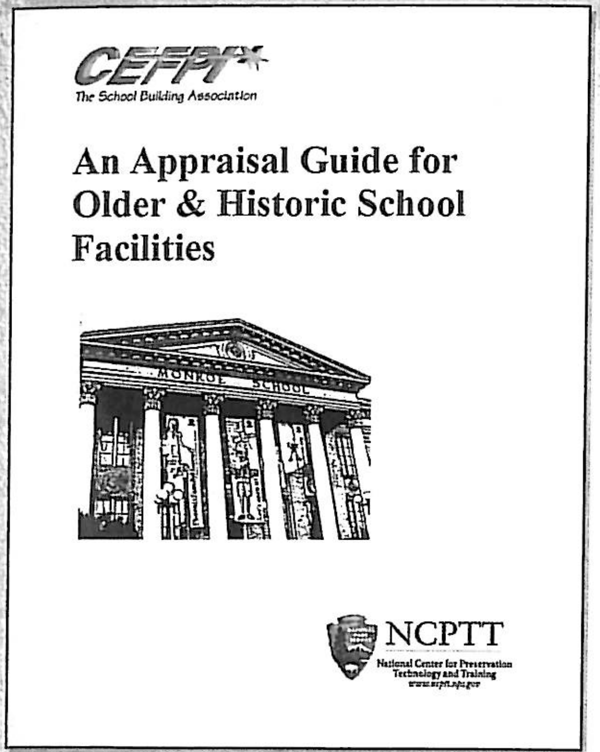

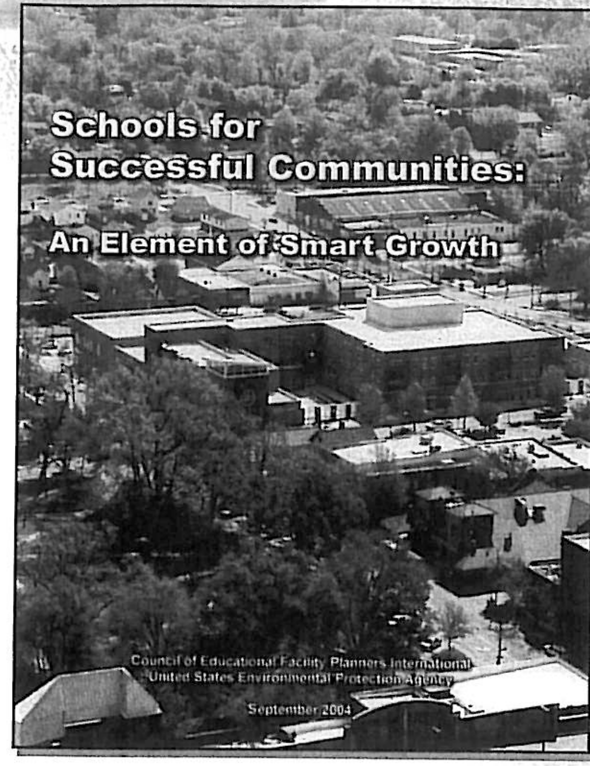

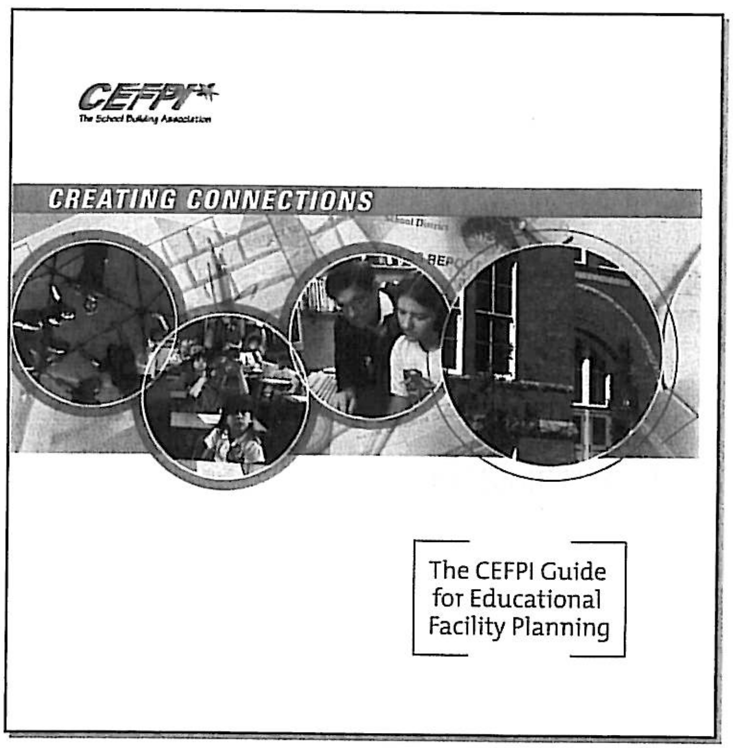

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